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Index to Advertisers—Page xiii.

Principal Contents:

	PAGE
A Healthy Atmosphere	681
Festive Lighting for the Coronation	683
Early Electrical Illuminations	686
Towards a National Tariff. By D. J. Bolton	687
Italian Water Power Plant	689
Combustion Equipment. By V. Walker	690
Standard Transformers. By S. H. Hemsley	691
Meetings and Discussions	693
Correspondence: Improvement in Urban Transport; Static Electricity; The Approach to Electrical Design; Price Reductions Bring Business	695
New Apparatus and Devices	697
Time-controlled Step-rate Prepayment Meter	698
Parliamentary News	701
Business and Industrial Notes	702
Electricity Supply	705
Traction and Communications	707
Contract Information	708
Notes	709
Our Personal Column	710
Financial Section	711
Published Specifications	715
New Work for Contractors	716

A Healthy Atmosphere

PHYSICAL well-being has always depended on the classic "elements"—earth, air, fire and water. Popular recognition of the outstanding importance of the second of these is shown in the merits ascribed to "fresh air" or "change of air" and in the interest taken in attempts to purify the atmosphere of our cities. Nevertheless, the attention paid to achieving the basic essential for bodily health is still surprisingly small, having regard to the thought devoted to increasing comfort in other, relatively superficial, aspects.

Ventilation, whether through faith that convection currents will impart the requisite motion to the atmosphere indoors and dilute its bacterial content or by opening windows and creating draughts, can be regarded only as an attempt to make bad conditions bearable. The colds and other ailments and the lassitude which sometimes follow an evening spent in a public hall, at a banquet, or after a train journey are more often due to an unhealthy atmosphere than is commonly supposed.

An appreciation of the point that good air is as essential as good entertainment is evident in the examples of cinema installations described recently in this journal, in which the results of a similar understanding of essentials, as indicated in the design of new and alterations to existing public buildings, hotels, flats and railway coaches, have also been discussed.

In air-conditioning we have a means—and it should be very largely an electrical means—of making our ambient air just what we choose it shall be. This, in its most complete form, includes the provision of plenum and extraction systems of dealing with washed and filtered air automatically maintained at correct temperature and humidity for any specific purpose, possibly with additions such as ozone.

The most difficult part is to secure a humidity low enough to enable moisture to be quickly evaporated from the skin, but, on the other hand, of a value that is high enough to avoid producing unpleasant dryness. As the amount of moisture that can be held in suspension increases with temperature, adequate cooling on a hot summer's day may raise the relative humidity unduly, and refrigeration is adopted in many cases to reduce the percentage saturation.

It probably will not be many years before the simpler ventilating schemes in use in factories will be superseded by something more ambitious. Just as it has been proved that good lighting in industry more than pays for itself in increased output and improved health of workers, so it will be found that maintenance of the temperature and humidity of the air within the narrow limits required for human efficiency will yield a handsome return.

That the advantages of air conditioning are due to other causes than extremes of climate is shown in two cases in the United States which were recently cited in the *Electrical World*, where the circumstances were such as to make them equally applicable to this country. In one, a crane track passed over the tops of an open-hearth furnace and a blooming mill, the heat from which made it almost impossible for the operator to remain in his cabin; the installation of a half-ton air-conditioning unit altered that. In the other instance, the glass-sided control room of a new blooming mill has been fitted with a one-ton refrigerating unit so that the attendant works in an environment which enables him to concentrate without fatigue on the operation of the plant.

There are other standpoints than those of human comfort which suggest fields for air-conditioning that still await thorough exploration. Our readers need be reminded only that the establishment of textile industries west of the Pennines is attributed to the peculiar merits of the prevailing atmospheric humidity for certain processes.

While it is not suggested that all the effects of Nature at her best can be emulated (or that air conditioning will ever be quite the same thing as a day at the seaside), it is at any rate possible to smooth out her more erratic manifestations and bring them up to a tolerable level by taking full advantage of electrical ways and means.

Coronation Floodlighting

NOT the least of the many changes which we have seen during the twenty-six years since the last Coronation is that which has taken place in decorative lighting. There were some good electrically illuminated displays in 1911, but the scope of vacuum metal-filament lamps and arcs was limited—although even they were more suitable and "flexible" than gas lighting. The subsequent invention of the gasfilled lamp and the development of electric-discharge lamps have brought about a veritable revolution in the art of decorative illumination. The result was seen to some extent during the Faraday Centenary and the Silver Jubilee celebrations, but these efforts will be surpassed by the extensive schemes which are being switched on next week. London will be transformed with light, while practically all the principal provincial cities and towns will have very effective displays. We reproduce in this issue a number of photographs, mostly taken by our own men, of some of the beautiful effects produced by floodlighting, and we hope to publish further examples next week.

Equity for Gas

THE Joint Committee of both Houses of Parliament set up last year to consider the question of gas prices has now made its recommendations. It will be recalled that the Committee's appointment was the result of public disapproval of a sliding-scale tariff instituted by the South Metropolitan Gas Co. to replace its flat rate, the consumer having no option but to submit to it. As is the case with most tariffs of this kind, it was designed to ensure that the small user paid at least the cost of providing the service, while the larger consumer benefited. Consequently, many small users found that their gas was to cost them more—hence the outcry. Flat rates for electricity, combined with a minimum quarterly charge, are usually large enough to cover the cost of supply, and the Committee recommends that gas companies, too, shall be empowered to make a minimum quarterly charge to protect them against the unremunerative consumer. This is equitable, but no doubt the gas companies will find, as electricity suppliers have often done, that it pays to waive the minimum charge and encourage people to use more by other means.

"Remote from the Facts"

A WEEK or two ago we commented upon a statement by a gas company chairman in which it was implied that electricity had no other use in the home than lighting. This wilful blindness appears to be general in the gas industry. During the proceedings of the above-mentioned Committee on Gas Prices it was suggested that electricity did not compete with gas for the custom of poor working-class districts. The Committee correctly says that this seems remote from the facts and points to the huge increase in the number of cookers at West Ham in the last nine years. Of course, as our readers know, West Ham, although an outstanding example, is only one of many of such cases. Is it possible that the gas industry hasn't heard about them?

Transformer Standards

SOME notes on the latest British Standard Specification for transformers (No. 171/1936) were given, immediately after its publication, in our issue of July 24th last. The new edition was needed in view of the considerable progress that had been made since 1927 (when the previous B.S.S., No. 72, was issued), which has been reflected in modifications and additions to the standard specifications of other countries. There seems to have been some delay in adopting the 1936 revisions, partly, no doubt, owing to their extensive character and partly owing to the difficulty of applying such recommendations as those relating to standard voltages (included for the first time) to existing systems. Also, no ruling was made, as is customary in official specifications in the United States and Germany, regarding the date upon which the new specification should come into force. During the past nine months it has given rise to a considerable amount of discussion in the industry, as it should do, and Mr. S. H. Hemsley in this issue voices some constructive criticisms that are based upon the comments of manufacturers and users during that period. These are on points of detail; the new specification as a whole may be regarded as a successful attempt to deal with a subject of the first importance on sound principles.

Cable Colours

THE method of distinguishing conductors by the colour of their insulation prescribed in the I.E.E. Wiring Regulations (Nos. 310, 311 and 1318c) is an excellent one, but it may be worse than useless if reasonable care is not taken to sort out the colours correctly. When a piece of apparatus is connected between the outer and neutral of a three-wire system red should obviously indicate the live wire in circuit with a single-pole switch, while black is the neutral. The earthing lead should be brown. Instances that have come to our notice recently include one in which printed instructions were given to connect the black wire to the earth terminal, another in which the red core was actually connected to the earth terminal, and a third in which the user was left without any information as to how to use the colours of the three-core flex. It is a pity that the same care that had evidently been shown in the design and manufacture of the three appliances taken as examples (out of many) could not have been extended to finishing them off ready for use.

Institution Membership

AN increase in membership of the Institution of Electrical Engineers by 611 during the last twelve months brought the total at April 1st to 17,399. The annual report of the Council shows that the number of full members has passed the 2,000 mark, and a net increase of twenty-seven made a better showing than was the case last year. The number applying for transfer from the associate members' class is still too small to make the senior grade what it ought to be numerically, and the proportion of the latter to the total is less than it was a few years ago. A satisfactory source for the recruitment of the corporate members is to be found, however, in the steadily enlarging percentage formed by the graduates, which is an encouraging sign of life.

Veterans

SEVENTY-TWO electrical engineers have been members of the Institution for half a century or more. The list includes the fifteen honorary members, those who have compounded for life, and others who have retired after reaching the age of sixty. There remain twenty-two members who do not come within these categories, and the Council has now decided that they also need not pay annual subscriptions. The new rule does not cut across the existing one under which retired members who are over sixty years of age, and who have been enrolled for twenty-five years, may apply for remission of their subscriptions. It is a pleasing gesture of appreciation of the support given to the building up of a great professional organisation. The older rule implies a recognition of the difficulty found by many who have aided in the development of a co-operative spirit in continuing their financial support of the Institution when no longer on the active list.

Constant Temperature

THE fine limits within which temperatures can be maintained by electrical means have considerably extended the use of electricity in industry, but values hitherto obtained seem coarse compared with that achieved by Mr. L. B. Turner with the isothermal chamber which he described to the I.E.E. Wireless Section on Wednesday. With fluctuating mains voltage and varying ambient conditions he has secured a constancy within 0.001 deg. C. His methods appear to lend themselves to the securing of commensurate results with chambers much larger than the one he showed or with small furnaces.

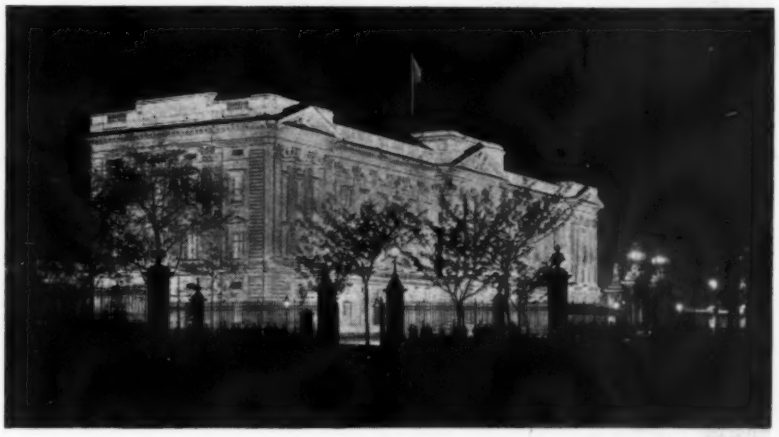
Festive Lighting for the Coronation

Two hundred large floodlighting installations in London alone

IN practically every city, town and village in Great Britain the finishing touches are now being put to Coronation illumination schemes, which both in number and effectiveness will easily surpass those seen in connection with the celebration of King George V's Jubilee. In London alone there will be in the neighbourhood of two hundred floodlighting installations, while in the provinces a very conservative estimate, arrived at from statistics supplied to E.L.M.A. by some 600 local authorities, puts the average additional load due to floodlighting and the large schemes of decorative lighting at approximately 60 kW per town. And this, of course, does not take into account the numerous smaller schemes of strip-lighting and illuminated devices with which so many of the shops, business premises, &c., are now being adorned.

Altogether it is anticipated that there will be an increased load due to the Coronation of nearly 200,000 kW, of which rather more than half will be employed for national and local government schemes. The demand for lamps is expected to rise to over ten millions.

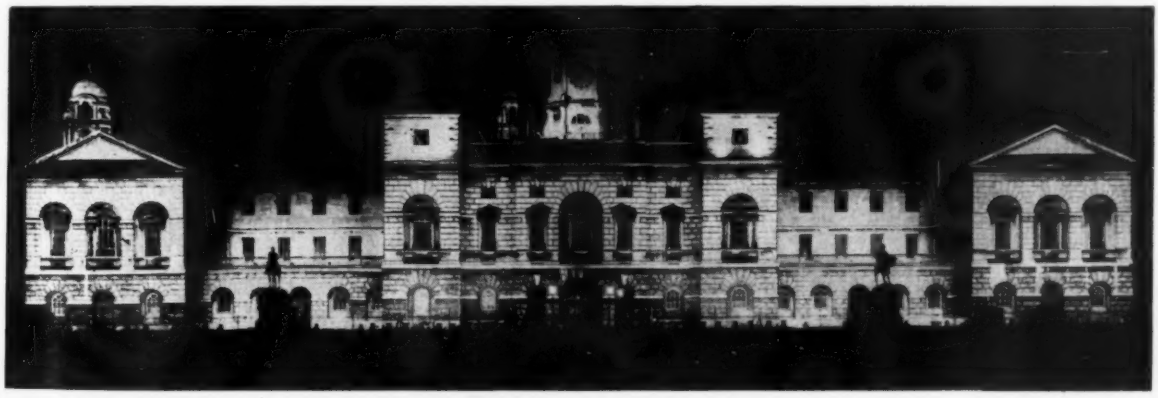
Most, if not all, of the principal London buildings floodlighted at the Jubilee Celebrations will again be illuminated in similar style, the installations in many cases being improved, however. Buckingham Palace and the Queen Victoria Memorial (G.E.C. equipment); St. James's Palace, the Mansion House, the Monument and the Tower Bridge (Siemens); the Admiralty Arch (B.T.H.); the National Gallery and Somerset House (Ediswan); and St. Paul's Cathedral (G.E.C. and Siemens) will all look much as they did at the Jubilee.



Buckingham Palace [*Elec. Rev. photo.*

The blue floodlighting of the Horse Guards, which was such an attractive feature of the 1935 celebrations, is to be repeated, this time using "Mazda Mercra" electric-discharge lamps entirely instead of including gasfilled lamps. The well-known blue-green "Mazda Mercra" lighting of the Thames façade of the L.C.C. County Hall is appropriately to be "crowned" by introducing a splash of red, from a battery of "Mazdalux" projectors fitted with red colour screens, to the roof and tower; the total load is 50 kW. For the first time the fountains in Trafalgar Square are being illuminated, in amber, by means of eight "Ediswan" submersible reflectors taking 500-W gasfilled lamps.

A feature of the illuminations at Westminster Abbey will be the use of the new "Holoflood" which Holophane, Ltd., have designed as a result of experiments in connection with the Jubilee lighting. The roof of the annexe has provided a new position for the projectors for lighting the West Towers; previously the illumination has come from the roofs of Westminster Hospital and the Central Hall and it is expected that the new arrangement will increase the light and shade effect of the architecture. The King Henry VII Chapel will be lighted from the ground and clerestory level, while the upper portions of the North Front which appear above the temporary stands will be floodlighted from the clerestory level upwards. Inside the Abbey a novel switching arrangement permits pairs of floodlights, one each side of the centre aisle, to be illuminated consecutively. Incidentally, forty-two Crompton "Silver Queen" fans are being used in the Abbey during the Coronation period.



Horse Guards, Whitehall [*Elec. Rev. photo.*

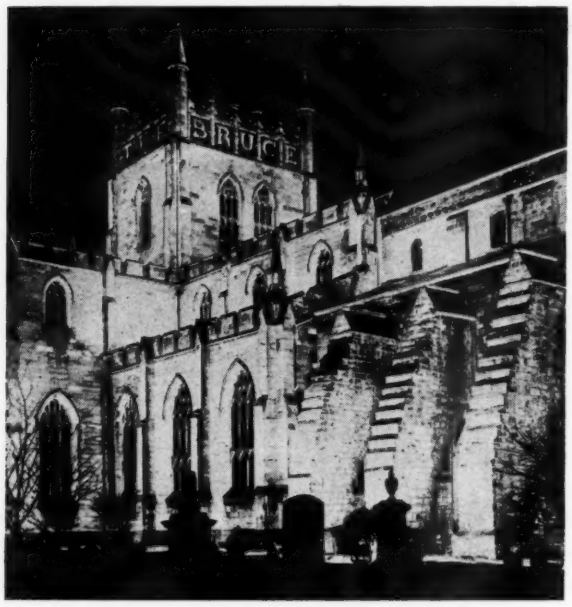
Hampton Court Palace

At the Tower of London the true sense of proportion is maintained by graduating the light from a low intensity on the walls of the moat to a stronger illumination on the casemate walls and battlements, and to a climax on the turrets and features of the White Tower. The equipment installed consists of 138 "Mazdalux" projectors (totalling 109 kW).

In addition to all four sides of "Big Ben," the terrace of the Houses of Parliament is being floodlighted for the first time. Siemens equipment is used for this as well as other prominent buildings, such as Australia House, the Royal Automobile Club, the Junior Constitutional Club, the Union Jack Club, the Incorporated Society of Accountants' building and a large number of city churches. India House and Rhodesia House (B.T.H.), the Central Hall, Westminster (Holophane),

and University College, Gower Street (Simplex), are other installations of especial interest.

Hampton Court Palace is being illuminated once more and



Dunfermline Abbey

on this occasion the intensity of the red "Osira" lighting is relieved by a number of standard filament floodlights. The lighting of the gardens is to be more extensive and the bridge, too, is included in the scheme. Other London installations in which G.E.C. equipment is utilised include:—Middlesex Guildhall and offices, Nobel House, I.C.I. House, Thames House, New Scotland Yard, the Athenæum Club, the I.E.E. Building, the Royal Institution, Inner Temple Hall, Unilever House, Bank of England (combined floodlighting and devices), the P.L.A. building, the Prudential and Pearl Insurance offices, Broadcasting House, D. H. Evans and Swan & Edgar's buildings, the Metropolitan Water Board Headquarters (including the fountains), Doulton's and St. Paul's School (red "Osira").

The G.E.C. also supplied the equipment employed for several churches, hotels (Claridge's, Berkeley, Savoy, Charing Cross &c.), and town halls (Holborn, St. Pancras, Kensington, Camberwell, St. Marylebone, &c.), and has supplied 150 special double-throw floodlights for illuminating banners in Bond Street. For installation in its principal showrooms the Northmet Co. has purchased "Osram" devices consisting of illuminated glass shields with papier mâché crowns and floral festoons. The G.E.C. tells us that a surprisingly large number of the installations in which it is concerned are of a more or less permanent character.

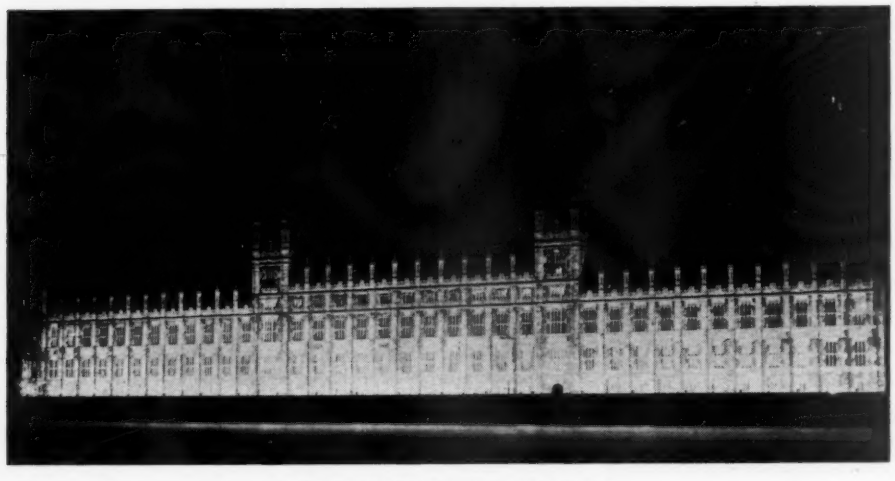
Two novelties for which the Strand Electric and Engineering Co., Ltd., is responsible are 30-ft. high electric "bonfires" with flame effects, on the roof of the Shell Mex House; and colour-changing equipment for illuminating 30-ft. high jets of water from fire floats stationed outside the new London Fire Brigade Headquarters. Striplighting from specially designed "pylons" is being installed along both sides of two miles of Croydon's main thoroughfare.

In the provinces several cities and towns can boast an additional load of over 300 kW due to special lighting schemes and among them may be numbered Liverpool (338 kW), Hastings (375 kW, including 199 kW for the Promenade), Edinburgh (393 kW, including 203 kW for the Castle), Manchester (358 kW), Birmingham (347 kW), and Bristol (352 kW). Among those with increased loads of over 200 kW are: Harrogate (272 kW), Worcester (258 kW), Portsmouth (238 kW), Rochdale (207 kW), Oldham (271 kW), Southend-on-Sea (241 kW), Plymouth (247 kW), Brighton (274 kW), York (269 kW), Weymouth (291 kW), and Cardiff (234 kW).

One of the most interesting installations outside London is that of St. George's Chapel, Windsor Castle. To avoid "flattening out" the architectural beauty of the building the opposite roofs have been used to provide a very soft general illumination only, the main lighting being disposed between the buttresses at ground level and between the flying buttresses on the clerestory roof. By using specially designed floodlights (G.E.C.) it has been possible to place the units at ground level so close to the building between the buttresses

London County Hall

that they are quite inconspicuous by night or day. Linking up with the lighting on the Norman Tower and the Round Tower, the Chapel floodlighting presents a remarkable spectacle. The total load is 125 kW, of which the Chapel takes 50 kW.



Terrace of the Houses of Parliament

What is said to be the largest scheme of sodium floodlighting yet undertaken in Great Britain has just been completed by the Fife Electric Power Co., Ltd., at Dunfermline Abbey, where thirty-one "Philora" lamps (total loading 4¼ kW) in specially designed Revo reflectors are employed. The varied and irregular surfaces, together with the low reflective nature of the aged sandstone presented serious problems, but skilful placing of the projectors has produced a remarkable definition of detail without glare. Another outstand-

Special Elec. Rev. photos.

ing Scottish installation is that of Edinburgh Castle (200 kW).

A procession of illuminated motor boats is planned at Chester, where illumination schemes include Clifford's Tower, the Guildhall, the City War Memorial, the city walls, the Mansion House, Four Bars, the river bridges and Rowntree Park. The illuminations of the Abbey Gardens and the streets were switched on at Bury St. Edmund's last Tuesday.

At Birmingham the Electric Supply Department is floodlighting the main entrances to the Council House and Museum and Art Gallery, the Town Hall, the equestrian groups in Victoria Square and Easy Row, the Hall of Memory, the Chamberlain Memorial Fountain, the Central Fire Station, St. Philip's Cathedral and St. Martin's Church. Decorative lighting is also being carried out in Cannon Hill, Handsworth, Small Heath, Ward End and Aston Parks, and in Queen's Park, Harborne. The Town Hall and Handsworth Park installations are two of many in which Siemens equipment is employed, others being the Royal Fort and St. Stephen's Church, Bristol; Lister & Co.'s Manningham Mills, Bradford; the Shipley Art Gallery, Gateshead; and Exeter Cathedral.

On the South Coast, Brighton Pavilion in colour, the old and new town halls at Worthing, and an illuminated model of the battleship Nelson in the Guildhall Square, Portsmouth, are notable G.E.C. efforts. Some of the more prominent installations reported by Holophane, Ltd., are Denbigh Castle; the Bank of Scotland, Edinburgh; St. Alban's Abbey; St. George's Church, Jesmond, Newcastle-on-Tyne; Brocket Hall, Herts; and the Royal Orphanage, Wanstead. Glasgow Municipal Buildings, Chepstow Castle, Sheffield Town Hall and the Mersey Tunnel ventilating shafts are typical B.T.H. jobs.

Early Electrical Illuminations

BY way of contrast to the ambitious and beautiful schemes of decorative illumination which are to be seen during this Coronation period we illustrate two examples of earlier efforts. They were both carried out by the late Mr. Thomas Lee Hellyar, a then well-known electrical manufacturer and contractor, at his premises in Hammersmith.

Mr. Hellyar had his own generating plant, comprising a vertical boiler and engine mounted on a cast-iron water-tank bedplate, by E. S. Hindley, of Bourton, Dorset, which by belting transmitted its power to a shunt-wound dynamo with a Pacinotti ring armature by Gramme and a series-wound dynamo known as an "arc lighter." In both these machines the brush holder spindle was fixed in the frame, and it was necessary to move the brushes of copper foil, bunched wire or layered gauze into the best position on the commutator while the machine was running under load; the frayed ends had to be trimmed almost daily before commencing to run.

In the absence of instruments the load on the series-wound dynamo was ascertained by placing the palms of both hands around the field windings and so ascertaining their temperature, disregarding the fact that they were painted with shellac varnish coloured with vermilion as an indication of danger. Pressure was arrived at by the brilliance of the lamps until an Ayrton & Perry volt meter with a press-button switch in its wood base was obtainable.

The plant upon several occasions served to illuminate a church hall across the highway, when used for bazaars and other special occasions. The flimsy decorations of the stalls and the goods were safely illuminated by incandescent electric lamps and an arc lamp served for general lighting. Current was conveyed by insulated cables suspended by wood spacers hung from a steel rope, and the conductors were those used in the installation of Jablochoff candles for street illumination on the Victoria Embankment.

When Mr. Hellyar entered into the field of manufacture he replaced the steam plant by a ¼-h.p. (nominal) Otto-Crossley horizontal gas engine, and the dynamos were replaced by a machine of his own manufacture. During 1895 a bipolar dynamo of 1¼-kW output, manufactured by Woodhouse & Rawson at the Cadby Hall Works, Kensington, was installed. A battery of accumulators with pasted plates contained in lead-lined teak boxes ensured a constant supply of electricity.

Although the electricity supply by the Hammersmith Borough Council was inaugurated in 1897, the plant on the premises provided the current necessary for the illumination of the Diamond Jubilee decoration scheme.

The scheme was simple but effective. The "congratulations" sign was of linen stretched over a wood frame and treated with aniline dye colours and the other signs and effects were printed matter upon transparent paper, obtainable for the occasion. The letters were made on the premises with batten type lampholders inserted through them, the edges having pinned to them glass drops, as used on the lustres and candelabra of the previous decade. A streamer of flags and bunting with lamps contained in celluloid spheres was stretched across the highway. It will be noticed that coloured glass buckets burning wax night-light candles augmented the carbon-lamp illumination. This was an electrical scheme and gas could not be permitted to appear, although the incandescent mantle had arrived and was electricity's keenest rival.

The progress of the business demanded more current and the generating plant was changed to a gas engine with tube ignition, a bipolar dynamo by Newtons, of Taunton, and a battery of accumulators with Planté type plates contained in glass boxes. This plant supplied the whole of the current for the illumination of the premises for Coronation celebrations of Edward VII.

The right-hand illustration shows this scheme. The whole of the elevation was draped with festoons held in position by gold colour cords and tassels. The centrepiece was of metal constructed as a box sign, the front of which was made up of glass lustre drops with a printed portrait of the King on transparent paper. The crown on a cushion was of metal carrying varnished coloured lamps and the letters were as for the Jubilee celebrations. Queen Alexandra was not overlooked; her portrait surmounted the scheme and use was made of the floral arts. The whole of the set pieces were produced on the premises and the use of metallic filament lamps permitted a greater intensity of illumination, but carbon filament lamps dipped-varnished on the premises to provide national colours were extensively used.

Illuminations for Queen Victoria's Diamond Jubilee and the Coronation of Edward VII

We are indebted to Mr. Ernest A. Hellyar for the information contained in this article and for the photographs.

Towards a National Tariff. By D. J. Bolton

Present and future prices for industrial power supplies

FEW ideas in electricity supply receive such extensive lip service as the thesis that tariffs should be simpler and more uniform. This is agreed to on all sides, not only by the consumers of energy, the manufacturers of apparatus, and the various publicity organisations, but even by the supply engineers themselves who are chiefly to blame for the present position. Nevertheless, all these excellent sentiments have so far led to no useful action whatever. The trouble is that agreement concerns only the disease and not the remedy, and while we all know what is wrong we quarrel violently as to how it should be put right.

The first step towards a cure is to study the nature and extent of the disease. A mere statement that there are so many hundred different tariffs throughout the country does not carry us very far. We require to know how much they differ from each other, and more particularly how many and what sizes of undertakings favour each type. A previous article dealt with domestic tariffs,* and the present one concerns the industrial field.

Survey of Existing Tariffs

The table below summarises the tariffs for industrial supplies as published by the authorised undertakings in this country. In order to keep the problem within manageable proportions only those selling 10 million kWh or over in the year 1932-3 are included, but these supply more than 90 per cent. of the energy sold, although they represent less than 30 per cent. of the undertakings. The very small undertaking, if it is to continue, may have to be regarded as a special case for tariff purposes.

The figures in the first two lines include two power companies selling to a few big consumers and without published tariffs. Of the remaining 171 undertakings about one-third offered simple flat rates either as their sole tariff or alternative to others. Approximately the same number offered two-part maximum demand tariffs with the fixed charges based either on kW or kVA (half of each sort). The mean of the numerical ratio between annual fixed charge in £ and running charge in pence was 11¼. (For this purpose the kVA charge was multiplied by 1.25, on the assumption of a power factor of 0.8.) In addition, there were nine two-part tariffs in which the fixed charge was based on connected load, either h.p. or kW, instead of on metered demand. (For brevity, this will be referred to as the h.p. basis.) Taking the m.d. tariffs only, 22 per cent. employed a sliding scale for the fixed charge, 14 per cent. did so for the kWh charge, and 7 per cent. did so for both. Thus, nearly half the m.d. tariffs were combined with a certain amount of sliding-scale adjustment for quantity.

	Number	Out of a total of	Proportion %
Undertakings selling over 10 million kWh	173	643	27
Total kWh sold by these undertakings (millions)	9,262	10,210	91
Undertakings offering simple flat rates (of these, four gave discounts of 20% or more for quantities)	55	171	32
Two-part m.d. tariffs (of these, half based their fixed charge on kVA, half on kW)	58	171	34
Sliding scale discounts were given in	25	58	43
Two-part tariffs based on connected load	9	171	5
Total two-part tariffs (Mean running charge 0.507d. per kWh).	67	171	39
Block-rate tariffs based on quantity alone (Average number of blocks. 3.7).	79	171	47
Block-rate tariffs based on m.d. or h.p.	25	171	14
Total block-rate tariffs (Mean follow-on rate, 0.9d. per kWh).	104	171	61
Tariffs varying with summer and winter	6	171	3½
Tariffs varying with time of day	1	171	0½

Coming now to the block-rate or sliding-scale tariffs, these were offered by 61 per cent. of the undertakings. Nearly four-fifths of these were pure quantity block rates, and the average number of blocks was 3.7. With the other fifth, the number of kWh in the various blocks depended either on m.d. or installed h.p. (about half of each). Usually, these had only two blocks, one much dearer than the other, and were really disguised two-part tariffs in which the fixed charge is spread over the earlier units instead of being levied directly. This was the tariff recommended by the Committee on Tariff Uniformity, but so far it appears to have made little headway.

In addition to these main types there were six tariffs in which the charge (or the kWh portion thereof) varied between summer and winter, while in one case there was a time-of-day variation.

The chief results are shown diagrammatically in fig. 1. It will be seen that the total number of block-rate and two-part tariffs just equalled the number of undertakings considered (represented in the diagram as a percentage). This is because practically all the undertakings offered one or the other, and the few which did neither were balanced by those which offered both.

Summing up the position, and leaving out the simple flat-rate tariffs, two broad principles emerge which may be called the "power and energy" principle, and the "discounts for quantity" principle. The former is based purely on cost considerations, whereas the latter has an eye chiefly for the selling aspect. From the costs point of view, only one-eighth of the total expenses of supply are directly proportional to the energy consumption, so that a fixed charge based on maximum demand seems the only logical way of recovering a considerable proportion of the costs. (It will be seen later that this "logic" is not entirely beyond reproach.) From the selling point of view, the outstanding feature is that the large consumer has a better chance than the small one of economically generating his own supply, and must, therefore, be given better terms. It is true that the costs of supplying him are also somewhat less, but not in nearly so great a ratio. Hence, the principle of charging less per kWh for larger amounts, which finds its chief expression in the block-rate tariff, must be regarded as primarily a selling device.

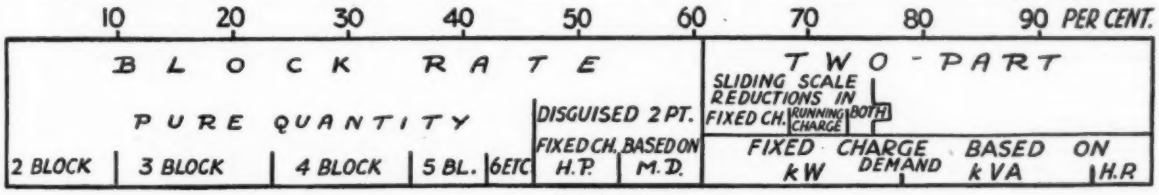


Fig. 1

In many cases the two principles are combined. Thus, a number of the two-part m.d. tariffs have sliding-scale adjustments, and on the other hand some of the block-rate tariffs make the size of block depend on an m.d. reading. It will be noted, however, that there were only thirty-three pure two-part tariffs (without any quantity adjustment), whereas there were seventy-nine pure quantity block-rate tariffs. It would appear, therefore, that of the two principles outlined above, the discount-for-quantity one is definitely more popular than the power-and-energy one. If, on the other hand, the block-rate tariff based on demand be regarded as a "disguised" two-part, the total of the two-part tariffs will be slightly greater than that of the pure quantity block rates.

It is not suggested that whatever is, is necessarily right; and, in fact, the very existence of so many types is proof of the contrary, since they cannot all be right. At the same time, if there is a substantial majority for one type, there is at least presumptive evidence that this is the best, and that practice will eventually settle down on these lines. Our main object must be to foresee this direction and to accelerate the process so that the intervening confusion shall be as little as possible.

Ideal Tariff

Since the two principles can be combined, the natural conclusion is that the ideal tariff would be a combination of the two. Probably this is true, but is such a theoretical ideal the thing to aim at? To put the question in a different way, as the block-rate tariff is easier to meter and to explain to consumers (since it is merely a series of flat rates) is the extra complication of a second meter and a second part to the tariff worth the trouble?

I am a firm believer in the two-part principle and consider that it is the only possible basis for costs expression, and the only tariff for large supplies with any pretensions to fairness. But when it comes to metering the individual demand of each small power consumer it is doubtful whether this is any real guide to peak responsibility. In fact, when the use period is tolerably the same for all consumers in a group, there is reason to believe that individual diversity largely reciprocates individual load factor, so that there is little ad-

* ELECTRICAL REVIEW, March 12th, 1937, page 391.

vantage in measuring the latter. Rather than trying to combine both principles into one, somewhat complicated, tariff, it would, therefore, seem better (if both are to be retained) to make them alternatives. The two-part tariff could be restricted to consumers above a certain magnitude, a plan that is already followed by several undertakings, *e.g.*, Leeds, Norwich and the Fife Electric Power Co.

The following is a summary of the main advantages of the block-rate tariff. Besides being simpler to meter and to explain, it avoids any necessity for quoting a flat-rate alternative, since the block rate is itself merely a series of flat rates. Owing to the operation of diversity, as explained above, power consumers of the same type and working hours

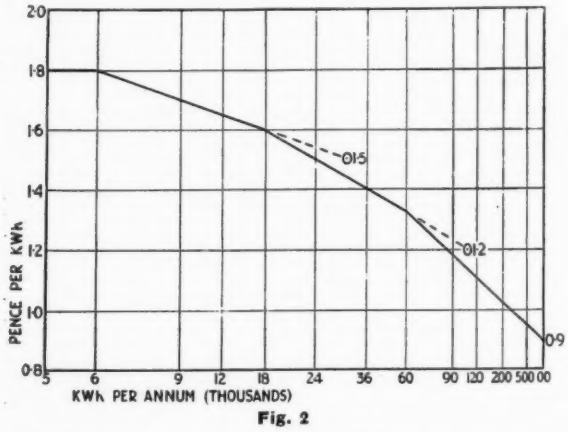


Fig. 2

will always tend to have a better load factor the larger the size. Thus, the operation of a two-part tariff will automatically lower the price to the large consumer, and to this extent will give results which could have been obtained from the block-rate tariff in a simpler and more obvious manner.

Against these advantages must be noted the following drawbacks. While reasonably representative of costs for consumers working normal hours, it is very wide of the mark for those whose use periods are liable to vary greatly. The fact that an undertaking buys in bulk on a two-part basis is a strong inducement to sell on a similar basis. But this is, in any case, only practicable for the power load (barely one-third of the total revenue) and the argument is only valid on the assumption that the consumers' load curve is a miniature replica of the group curve, *i.e.*, neglecting this factor of differential diversity. A third objection to the block-rate tariff is the difficulty of charging for power factor, and this point requires further consideration. Also, the block rate is somewhat more jerky and less smooth in its operation unless the number of blocks is large.

Now comes the more difficult and specific part of the task, namely, to construct an actual block-rate tariff which might command universal acceptance. The only possible starting point is to take the mean of present practice and then to see how much the extremes vary from this mean. Unfortunately, owing to the number of possible variables no other tariff presents so wide a profusion of types. The number of blocks, the size and proportions of the blocks, and the proportions of the prices in each, can all vary, quite apart from variations in the actual magnitudes of the prices. In fact, of the 104 block-rate tariffs listed above only two pairs are alike or even nearly alike, and had there been a thousand instead of a hundred the chances are much against more than two or three of them being identical.

An "Average" Block-rate Tariff

Taking the pure quantity block-rate tariffs (not dependent on m.d.) the average number of blocks, including the final "follow-on" one, is 3.7, the mean price for the first block is 1.8d. and for the last one 0.9d. The mean size of the first block is 8,200 kWh per annum. In a number of cases the blocks were all the same size, and occasionally they decreased in size, but the usual practice was to make them of ascending magnitudes. Piecing together all these various mean values gives the following as a sort of "average" block-rate tariff (the figures have been rounded off so as to give simple values per month and per quarter):—

First 6,000 kWh per annum, 1.8d.; next 12,000, 1.5d.; next 42,000, 1.2d.; all over 60,000, 0.9d.

The operation of such a tariff can best be shown by plotting the mean price per kWh (uniform vertical scale) to a base of kWh consumed annually. If the base scale is made a reciprocal one this will have the advantage that the graph will consist entirely of straight lines, and that very large consumptions can be shown. Such a graph is shown in fig. 2, but in this case the base scale is in three different portions in order to avoid undue cramping of the right-hand end. It will be seen that for all consumptions up to 6,000 kWh per annum the rate is 1.8d. per kWh. Subsequent kWh are sold more cheaply so that the mean price falls, and it would reach a figure of 0.9d. if the consumption were infinitely large.

Two-part Alternative

For industrial consumers likely to have extended working hours, for commercial consumers (probably), and for all consumers above a certain magnitude a two-part tariff could be put forward, or it might be offered as a straight alternative throughout. In constructing such a tariff it is best to take one's stand, as before, on the mean of present practice. Fortunately, the number of variables is far less, and classification is correspondingly easier; it is even possible to find several tariffs alike or very nearly so.

The mean running charge is just over a halfpenny (0.507d.) per kWh, and the mean fixed charge is £5 15s. per annum per kW (or £4 12s. per kVA). Hence the numerical ratio between the two parts, as defined above, is 11½. If the tariff were confined to the larger consumers the figures might be reduced slightly and rounded off to, say, £5 per kW plus ½d. per kWh. This would have the advantage of a slightly smaller ratio between the parts, and hence a bigger allowance for "differential diversity."

Comparing the incidence of this "average" two-part tariff with that of the "average" block-rate tariff, the former depends upon load factor and the latter on total load, but the two can be to some extent harmonised by means of the theory of diversity already referred to. On this assumption, a very large power consumer having almost perfect diversity within his own working hours, and working, say, 50 hours a week should have a load factor approaching $50/7\times24=30$ per cent. His overall payment on the above two-part tariff would then amount to 0.96d. per kWh. By the block-rate tariff, the price would average the same figure when the annual consumption was about 400,000 kWh. A small consumer having little internal diversity would be likely to achieve a much smaller load factor. If his load factor were of the order 10 to 12 per cent., his overall price on the two-part tariff would be 1.8d., just the same as on the block-rate tariff.

Effect of Special Agreements

It must be realised that these suggestions are for *maximum* prices, and are intended to represent what could safely be offered in all but exceptionally difficult areas. There is nothing to prevent undertakings quoting below the prescribed figures, although it is suggested that all published tariffs should be of the same form and proportions as the standard ones. Even at present, many large contracts are made the subject of special agreements lower than the published tariffs. In fact the overall mean price for power supplies in the year 1934-5 was 0.7d., which is considerably lower than would be suggested by the average tariffs just given.

The general conclusions from this study are as follows: Assuming that a block-rate tariff is found desirable or necessary (as it has been by a hundred of the larger undertakings) there is no logical or practical reason why there should be a hundred different varieties, which correspond to no discoverable geographical distribution or industrial characteristics, but appear to be the purely haphazard result of each area pleasing itself regardless of its neighbours. Empiricism may be an excellent way (sometimes the only way) of finally arriving at the truth, but a hundred attempts should not arrive at a hundred different truths. I have, therefore, boldly constructed a single tariff, the mean of the present ones, which I believe to be as good as any of them and capable of serving as a type for them all.

The two-part m.d. tariff is shown to be definitely inferior in popularity, and there are sound theoretical reasons for this preference. For the normal small power consumer a two-part tariff would appear to be an unnecessary complication, but for cases where it is desired (*e.g.*, for the large industrialist) a suitable one has been constructed. This has the merits that it is approximately the mean of the ones now in use, its proportions are reasonable, and it gives results consistent with the block-rate tariff. It can, therefore, be made an extension of the latter without introducing serious anomalies or jerks in its application.

Transport Congress

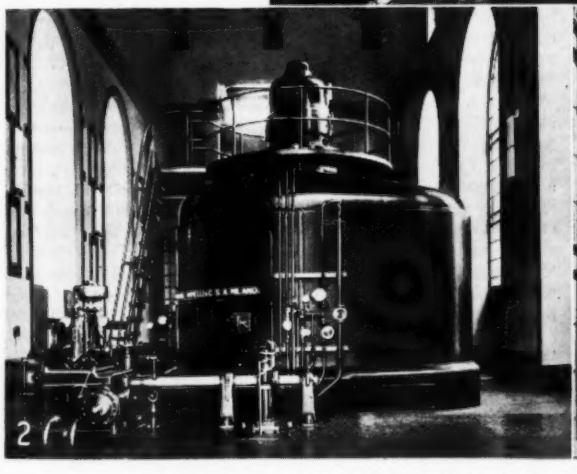
The annual congress of the Tramways, Light Railways and Transport Association will be held in Edinburgh from June 9th to 12th. Two papers will be read, Mr. R. McLeod, general manager of the City Transport Department, contributing one on "Edinburgh's Municipal Transport System," and Messrs. C. Roe and B. H. Davies one on "Composite, or All-metal Bodies."

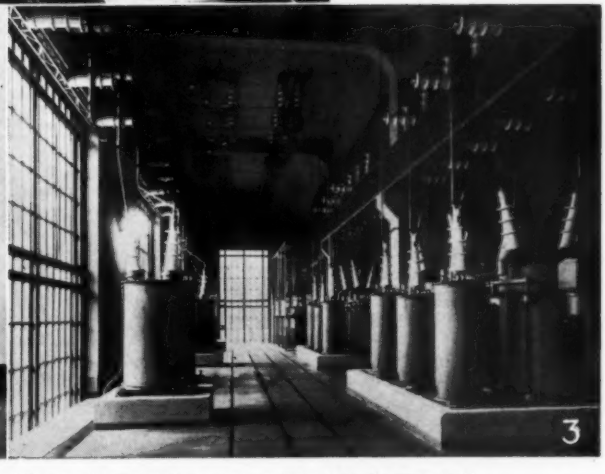
Italian Water Power Plant

The Vobarno station

THE hydro-electric generating plant recently built at Vobarno, northern Lombardy, for the Società Elettrica Bresciana, is situated at the source of the Chiese river, near the Swiss border, where the river flows out of Lake Idro.

The lake is controlled by two revolving sluice gates while two water intakes provide for a flow of about 6,600 gallons per second. As the site did not permit of the construction of a basin at the end of the conduits, these have been widened out to a section of 538 sq. ft. instead. Three downtake pipes to the power plant below run from this widened section, providing a head of about 338 ft. Each conduit has a butterfly valve at the top. The control of these valves, as well as of the sluice gates on the lake, are centralised in a building placed over the water intake for the plant.





1. A general view of the Vobarno plant. 2. One of the turbo-generator sets. 3. The transformer hall

The station is at the foot of the hill at right angles to the conduits. The building contains two long parallel halls; one is the machine room and the other an indoor sub-station. There are two turbo-generator sets, with space left for a third. Each consists of a 11,500 h.p. vertical axis reaction type Francis turbine passing 2,200 gallons per second under a head of about 337 ft. 6 in. They are designed to rotate at either 500 or at 420 r.p.m., for which purpose movable blades are provided.

The modern exterior of the Vobarno station

Directly connected to the turbine is a vertical Marelli generator rated at 11,500 kVA, 3-phase. The frequency may be either 42 or 50, depending on the speed at which the turbine is regulated, and the voltage can be varied from 6,000 to 7,000 V. The generators were built in sections to facilitate transport, and assembled on the spot. The main exciter (70 kW) has, in turn, a secondary exciter mounted also on the same shaft. The generators are designed for a continuous overload of 10 per cent. and a three-hour overload of 25 per cent. without heating up by more than 18 deg. F.

At one end of the machine room is a storage battery and (connected to the main bus bars of the low-voltage system) a 200-kVA 6,500/220/127-V step-down transformer from which the lighting and auxiliary services of the station are fed. Above this room, forming a balcony to the machine room, is the switchboard, the various controls for the generators themselves being on a pulpit-type board set to overlook the generators.

In the sub-station section of the building the lower floor is occupied by the low-voltage bus bars, with their oil switches, and by the transformers, while on the upper floor are the high-voltage bars and their switches. Two sets of transformers are provided, one stepping up to 70 kV and the others to 40 kV. The former are of 11,500 kVA, 42/50 cycles, 6,500/65,000 V with subsidiary taps. The primary is delta and the secondary star connected, with the neutral brought out. These transformers, which are built for external oil circulation, water cooled, can operate at either 6,000 or at 7,000 V. The second set of transformers is of 6,500/40,000 V, 2,500 kVA, 42 cycles, also with subsidiary taps; this bank is provided with natural cooling.

Between each of these sets of transformers and the generators are oil switches with a rupturing capacity of 400,000 kVA. Three sets are installed, one set controlling each of the two sets of transformers, and the third for the outgoing 6,500-V line.

The switches on the first floor for the 70-kV line have a rupturing capacity of 600,000 kVA. The 40-kV line is provided with 275,000-kVA switches.

Welded Steam Plant

A well illustrated booklet (No. 1219) technically describing the utilisation of metallic arc welding in the construction of steam generating plant (boiler drums, pressure vessels, nozzles and pipes) has been issued by Babcock & Wilcox, Ltd. It is a reprint of a paper by Dr. H. Harris, Renfrew works metallurgist, which was read some time ago before the Scottish branch of the Institution of Mechanical Engineers. The author makes a partial survey of the basic principles and metallurgical considerations involved, while the manufacturing process itself and the welding machines employed are described. Reference is made to distortion and methods of stress relief, and to inspection and examination, including the radiography of whole welded parts.

Combustion Equipment.

By V. Walker, A.M.I.E.E.

Recent developments

EXPERIMENTS have recently been carried out at a large American power station with under-feed stokers in which the tuyeres are water cooled with a view to enabling the plant to burn cheap coal having a low fusion temperature of ash (1,900 deg. F.). The standard type under-feed stoker was unable to burn this coal satisfactorily at a rate which would evaporate the required amount of steam, the chief difficulty being the formation of clinker.

In order to reduce the temperature of the fuel bed, and in the zone surrounding the stoker mechanism, water-wall tubes were installed on the stoker as an extension of the existing La Mont water walls. Three tubes were recessed in each tuyere stack, and carried down over the extension grates, so as to cool the tuyeres and bottom of the fuel bed, the effect being to freeze the ash some distance upwards into the fuel bed. The unrestricted flow of air thus permitted in the fuel bed enabled the stoker to function satisfactorily.

Previously, a boiler could not be kept in service for more than an hour at normal load when burning low-fusion ash coal, which can now be burnt at the rate of 55 lb. per sq. ft of stoker (air admission part only) with no ill effects, the limiting factors being sufficient air and steam relieving capacity of the boilers.

Seven stokers were modified in this way and a new stoker was designed specially for water-cooled tuyeres. The later design is marked by the absence of the moving over-feed stoker which characterises high-duty under-feed stokers. Besides the three tubes fitted along the tuyeres, the same number of tubes were led from a header under the stoker and over the back of the retorts.

Effects of Water Cooling

The effects of water cooling stokers experienced so far are:—(1) Reduction of power to drive the stoker, because the fuel bed is less compact and moves more freely, and fused ash does not accumulate on the underfeed section; (2) reduction of boiler outage; (3) reduction of stoker and furnace maintenance; (4) high fuel-burning rates; (5) high air temperatures permissible.

Generally little difficulty is experienced when employing under-feed stokers using cold air, but clinker forms on the tuyeres when using highly pre-heated air, even when the ash fusion temperature is as much as 2,700 deg. F. The fires must then be burned down and the clinkers removed. A water jet has been used to crack loose firmly adhering clinkers, but this practice may lead to cracking of stoker parts. A paper before the A.S.M.E., giving the results of investigations of the maintenance cost of under-feed stokers, leads to the conclusion that the cost is not greatly increased by pre-heating of the air up to 300 to 350 deg. F., but above this it increases sharply.

Extension grates of carborundum blocks appear to save considerably in maintenance as compared with iron extension grate bars when the air is highly pre-heated. Replacements are generally required due to cracking of the blocks at the smallest cross section. The blocks at the bottom of the extension plates also suffer from erosion.

Refractory slag drips have been installed at the furnace sides at the top of the c.i. water blocks of the walls of under-feed stokers to prevent the formation of slag on the blocks. These were originally of carborundum, the bottom of which projected some 4½ in. into the furnace; they were installed in six horizontal steps extending from the front wall to the extension grates. A later design consists of bare tubes above and extending beyond the face of the armoured section of the side walls. Slag running down the side wall comes in contact with the cooling tubes, and drops on the fuel bed without interfering with the normal operation of the stoker.

The maximum benefit has been derived from the use of auxiliary over-fire air, projected with sufficient velocity to penetrate and mix with the gas stream. This is preferably fed through the back or side at a pressure of 6 to 9 in. w.g. A small amount of air supplied through the front has often been found totally inadequate.

Metered Air Control

Metered air control has been adopted by the Detroit Edison Co., and the Brooklyn Edison Co. The zoned air-control equipment provides a means of regulating the quantity of air individually to each of the sections of the fuel bed, which may number over 70 in a large under-feed stoker. The underneath side of each tuyere row comprising the main part of the stoker is provided with four control boxes and the extension grates with five, the stokers being 15 retorts wide and having 694 sq. ft. of projected grate surface.

The control is in the form of a Venturi tube, and provides the entrance and throat pressure connections to a differential oil gauge mounted on the stoker control panel. Each control box is also fitted with a regulating damper connected by wires to a knob on the control panel. These indicators and controls enable the operators to regulate the air manually to any section of the fuel bed, and thus maintain uniform air supply to all sections of a given zone, and to proportion the air properly between zones. Light sections of the fuel bed can be immediately noted and corrected before they develop into holes.

In other plants the Venturi boxes and gauges are installed without external damper operation, in which case, when the gauges indicate a thin fire, manipulation of the pushers correct the fuel bed. This arrangement is expected to increase the steaming rate and make operation easier.

It is difficult as yet to determine what effect the air control has on the results obtained. The Detroit Edison Co. is making comparative tests. The Brooklyn Edison Co. found no improvement in efficiency over that of the previous six months without air control, but it is generally agreed that there is improvement in operation at high coal burning rates, the available peak capacity being raised 30 to 40 per cent. The blowing of cinders from the fuel bed is also eliminated.

Thin Tuyeres

The use of thin tuyeres (¾ to 1 in. thick compared with the usual 1½ in.) for under-feed stokers has resulted in reduction in stoker maintenance and increased uniformity of fuel bed. When burning coal having a high iron and sulphur content, in which the iron appears to separate and run down the tuyeres causing trouble in the fuel bed, the thin type of tuyeres has proved very successful, and also reduces the amount of fines lifted from the fuel bed.

When burning small sizes of anthracite on travelling-grate stokers the low volatile content of the fuel makes it necessary to shield the ignition end of the fuel bed from the cooling effect of the boiler tubes. This is sometimes accomplished by a front curtain wall and a low rear arch or by a combination of front and rear arch. The latter arrangement eliminates stratification of the products of combustion. The fuel bed should be uniform and the air supply zoned and controlled as to pressure and volume, and the grate surface must be such as to minimise the sifting of fines, while at the same time passing sufficient air.

Burning coke breeze is difficult, due to the low volatile content (between 2 and 7 per cent.), ignition being slow. Some dust, say 20 to 30 per cent., should be used in order to assist ignition. Usually, a front arch is employed, but in certain designs a rear arch has been employed to some advantage. The rear arch is higher than when employed to burn anthracite. Lignite having a moisture content of about 30 per cent. is burnt in a setting employing a long rear arch with a front curtain wall. The fuel is crushed to about 1 in. size, and the fuel bed is about 8 in. thick.

Chain grates are particularly suitable for free-burning non-caking and non-coking coals, and multiple-retort stokers for burning caking and coking coals in which the fuel bed requires constant ignition, although free burning coals are burnt successfully on this type of stoker. The best coal for the under-feed type of stoker contains a large proportion of ¾ to 1¼-in. nuts to support the fuel bed. Free-burning coal of approximately 10 per cent. ash and 10 per cent. moisture is more suitable for chain grates. As the fusion temperature of the ash decreases and ash content increases, the under-feed stoker has the advantage.

Non-uniform coal feeding is probably responsible for more stoker difficulties than has been appreciated. With under-feed stokers a variation in the amount of coal delivered per stroke of the ram causes unevenness in the fuel bed and leads to operating troubles, especially when the coal is wet or when segregation takes place in the bunker or stoker hoppers. Non-segregation coal chutes do not entirely eliminate the difficulty.

The Electrical Association for Women

The E.A.W. summer school of electrical housecraft for domestic science teachers is to be held this year at the Glasgow and West of Scotland College of Domestic Science, from August 26th to 31st. The syllabus includes lectures on the construction and use of domestic electrical appliances, lighting and electrical economics and terminology in relation to the teaching of electrical subjects in schools. Some time will also be devoted to practical work. The last morning of the course will be spent at the Royal Technical College, Glasgow, where Professor Parker Smith, head of the Electrical Engineering Department, has arranged an interesting programme. A visit to the Carron Company's works to inspect the manufacture of electric cookers has also been planned. The closing date for applications for the course is June 7th.

Standard Transformers.

By S. H. Hemsley, B.Sc., A.M.I.E.E.

Experience with B.S.S. No. 171—1936

THE following criticisms of the revised British Standard Specification for Power and Lighting Transformers are made in the light of experience since its publication last July. It is virtually a new specification, and containing eighty-four pages B.S.S. 171—1936, with its ninety clauses in eleven sections is more than half as long again as its predecessor (No. 72—1927), although a complete section dealing with the measurement of voltage with spark gaps has been omitted. The main body occupies slightly less than half the total space, the remainder being taken up by eleven appendices; the whole represents a serious and commendable effort on the part of manufacturers and users to produce a comprehensive specification that is representative of the considerable progress made in the design and construction of transformers during the past ten years.

The specification covers power and lighting transformers (including auto-transformers), continuously rated, of 1 kVA or over, single-phase, and 5 kVA or over, polyphase. Certain special transformers, such as those for constant-current power and lighting, instruments, traction and testing, auto-starters and induction regulators do not come within its scope and separate specifications are being considered for mercury-arc rectifier and rotary-convertor transformers.

For mining-type transformers the specification, in so far as it applies, is to be read in conjunction with B.S.S. No. 355, which refers to limiting dimensions, tank details and standard flanges for boxes. It is doubtful whether this method of bringing B.S.S. No. 355 up-to-date is the most satisfactory, since it refers to specific sections of B.S.S. No. 171—1927.

In referring to windings the word "voltage" is now used instead of "tension," but consistency is not maintained throughout (*vide* appendix J). The conventional tertiary winding of a transformer is defined, but its common use in limiting current flowing in the transformer under fault conditions might have been mentioned. The section on cooling now includes mixed natural and artificial methods, and in most large transformers a certain percentage of the full-load rating is available with natural cooling only.

Standard kVA ratings and standard voltages are tabulated as definite standards and not merely recommendations as previously. Maximum kVA ratings have been extended from 10,000 to 25,000 kVA single-phase, and from 30,000 to 75,000 kVA three-phase, but these are not the largest units built in this country.

A table giving recommended minimum sizes in kVA for different voltages and types of cooling would have been advantageous especially to the purchaser; the values stated would necessarily be elastic, but would have formed a guide as to the lower economical limits of manufacture. Some broad idea of these is given in a table of time constants, but more exact information would have been welcome, particularly to overseas customers.

An Important Alteration

Probably the most important alteration made in the new specification is the increase in permissible average temperature rise, as measured by increase in resistance of the windings, from 55 deg. C. (1927) to 60 deg. C. (1936) for O.N. type transformers, Class A insulation, and from 65 deg. C. to 70 deg. C. for O.F.W. type transformers; the permissible oil temperature rise as measured by thermometer still remains 50 deg. C. for all oil-immersed types. Further, the ambient-air temperature is taken to have an average value of 35 deg. C. over 24-hour periods, and a peak value of 40 deg. C. These modifications take account of the average temperature gradient obtaining in transformers of normal design and bring the 1936 specification generally in line with those in force in other countries, viz., A.I.E.E. Standard No. 13 in the United States, V.D.E. Rules 0532—1934 in Germany, the S.E.V. Rules, 1923, Bulletin, Vol. 14, in Switzerland and S.E.N.4 (1930) in Sweden.

With the previous difference of only 50 deg. C. between the average temperature rise by resistance and the maximum oil rise it was usually necessary, with the medium-sized O.N. transformers, to allow an oil rise of 47 deg. C. or less in order that the temperature rise by resistance should not exceed 55 deg. C. Since a large number of transformers are still loaded according to the oil temperature rise, this gave a false sense of security, and the tendency has been frequently to exceed the safe thermal rating of the transformer when subjected to overload.

The position in regard to the specified ambient-air temperature, however, is not so satisfactory. It has been recognised for some considerable time that an ambient temperature of 40 deg. C. is very rarely attained in this country in places where transformers are installed, and that this value should be appreciably reduced, but the values which are now specified are somewhat indeterminate.

The true thermal rating of a transformer is the maximum temperature the insulation will withstand without damage. This "hottest-spot temperature" for O.N. transformers is equal to the temperature of the ambient air, plus the hottest oil temperature rise, plus the maximum difference in temperature between the windings and oil (temperature gradient); also the average temperature as measured by resistance is equal to the temperature of the ambient air, plus the average oil temperature rise, plus the average temperature gradient. The word "average" in this connection should not be confused with the "average value over 24-hour periods" used in connection with the ambient-air temperature. The temperature of the hottest oil and the temperature gradients are independent and controlled by entirely separate factors. The temperature gradient is determined only by the total copper loss and the thermal design of the transformer.

Hottest-spot Temperature

Since the thermal capacity of the windings is small compared with the capacity of the transformer as a whole, an overload of short duration will increase the temperature gradient almost as much as the same steady continuous overload, the time constant being of the order of eight minutes or less. In determining the hottest-spot temperature the maximum value of 40 deg. C. for the ambient air will therefore be used, except in special cases, but no mention is made of this. Further, the permissible hottest-spot temperature is not stated, in spite of its fundamental importance, but is simply suggested as 105 deg. C. when the cooling medium is air (a value that has been in use for some years) in the section dealing with short-circuit conditions and temperature calculations.

That section is a valuable addition. It gives, first, the permissible duration in seconds of a short-circuit applied to transformers having various values of impedance. It also stipulates that a transformer or auto-transformer having an impedance of less than 4 per cent. shall be capable of withstanding not more than twenty-five times full-load current for two seconds without injury. An approximate formula is given for calculating the increase in temperature during short-circuit, assuming that the steady initial temperature is 105 deg. C. (as referred to above) and that the maximum temperature does not exceed 250 deg. C., the maximum duration of a short-circuit being five seconds.

The temperature rise formula is identical in substance with that given in the American I.E.E. Standards for Transformers (1930), in which the initial temperature of the windings (T_o+234.5 deg. C.) is referred to as the "absolute initial temperature." This is incorrect, since 234.5 deg. C. is an arbitrary reference temperature associated with resistance values of copper, and not the absolute zero of temperature as usually understood, *i.e.*, 273.2 deg. C.

A simpler formula contained in the Swedish Rules for Transformers (S.E.N.4—1930) gives results approximately 2 deg. C. higher for all normal values of current density and for time intervals up to ten seconds. For practical purposes, when the formula is used frequently, it can conveniently be reproduced in a series of curves with temperature rise T plotted against current density A for different values of time s, suitable values being assumed for the remaining unknowns. It is recommended that the maximum short-circuit currents to which series-connected transformer plant should be subjected are limited to twenty times full-load current in the case of voltage-regulators and to twenty-five times for auto-transformers.

Calculating Temperature Rise

Transformers cannot always be tested with the full losses corresponding to normal load, and corrections for the full-load temperature rise from observed data are given; thus the temperature rise of the oil at normal load above the cooling medium can be obtained from the temperature rise of the oil at the load under test by a simple calculation from the total measured losses, and the temperature gradient of the windings at normal from the test gradient and the measured current. The values of the indices p and q used in these corrections are fairly representative of normal transformers, and the usual assumption that $q=2p$ has been made. The indices appear to be lower than those obtained from investigations carried out on the Continent in 1931 and later, whilst, strictly speaking, different values should be used for the higher- and lower-voltage windings; the net difference in temperature rise, however, is not appreciable.

Closely allied to these sections is an appendix dealing with permissible overloads, in which practically the whole of the

matter is new, and although the determination of the duration of given overloads is slightly more complicated than before, the whole basis of the data is more logical and scientific.

The different values of time constants for transformers having various voltage ratios and types of cooling are now taken into account, and since these may vary from 1.0 to 5.0, or from 2.0 to 5.0 for one particular type of cooling, they affect the duration of overload appreciably. Two tables are given, the first stating the basic duration of overloads in minutes for various initial heating conditions, types of cooling, and for overloads from 10 to 100 per cent.; the second gives the time constants in hours for various methods of cooling, kVA and voltage.

A note defines the time constants; no indication is given of the method of arriving at these, but they agree fairly well with results calculated from the more usual formulæ. The duration of overload in minutes is obtained by multiplying the appropriate value from the first table by the time constant from the second table. As a complete study of overloads and thermal ratings, a paper read before the I.E.E. some years ago can still be recommended.[1]

Reverting to performance tests, where doubt exists as to the accuracy of the iron-loss measurement (due to variation in voltage wave form) it is recommended that the measurement should be checked by means of an average voltmeter or equivalent instrument. When the supply is obtained from a small machine, that is, when the impedance of the test circuit external to the transformer is not negligible, or a weak machine field is used, distortion of the voltage wave occurs, and the measured iron loss differs considerably from that obtainable with a pure sine-wave voltage. In such cases the applied voltage should be determined by means of an instrument giving the mean value of voltage instead of the r.m.s. value.

The "iron-loss voltmeter" is used fairly widely, but effects only an approximate compensation, and the final value should be ascertained with the average voltmeter. A method similar in principle to that of the iron-loss voltmeter, where a small standard transformer is connected in circuit, can also be used for most commercial purposes when neither of the above instruments is available.

High-voltage Testing

Another series of important modifications is embodied in the considerably enlarged section on high-voltage testing. Differentiation is made between transformers used in lightning and non-lightning areas and between fully insulated and graded insulated windings. Tests are considered in relation to whether the system is fully insulated or directly or indirectly earthed. It is stated that Great Britain is generally considered as lying in a non-lightning area, although probably exceptions would be made to this.

The magnitudes of the test voltages for applied and induced high-voltage tests are summarised in two tables in terms of the ordinary line voltage or "service voltage" of the transformer. In comparing the descriptive and tabulated values, it is difficult at first to reconcile the "terminal voltage to earth" and the "service voltage," but diagrams make the voltages applicable clear, provided the conditions of earthing of the systems are known.

In the 1927 specification the clause describing the method of making these tests was read in conjunction with an appendix which gave full data on the measurement of voltages by spark gaps and included the various corrections to be made. This information has now been modified and expanded according to the latest experimental data available, and is incorporated in a separate specification (No. 358—1929).

Formulæ for calculating inherent voltage regulation are again stated, although certain of the symbols have been modified. Attention might helpfully have been drawn to the application of the formulæ as stated to loads having a lagging power factor, since they are used at times for calculating the regulation of windings carrying a condenser load for power-factor correction. No reference is made to the method of calculating the regulation of three-winding transformers, which is given in the Test Code for Transformers issued at present in report form for purposes of criticism by the American I.E.E.

The information to be given with an inquiry or order for transformers is explained in an appendix, and typical illustrations of standard terminal and cable-box arrangements are included. If intending purchasers would give all relevant information of their requirements and the conditions under which transformer plant will be operated in the first place, a considerable amount of time and correspondence would be saved both for the manufacturer and purchaser. A desirable new provision is that the relative kVA ratings of transformers required for parallel operation shall not exceed the ratio 1 : 3.

The appendix also describes standard fittings recommended for tanks with illustrations showing their positions. The standard rating plates make no provision for transformers rated with a given secondary voltage at some specified load and power factor, presumably since this would not be in accordance with the somewhat illogical method of defining the standard rating in terms of no-load voltage and full-load current. Such a transformer would apparently be given an increased kVA rating, and an additional rating plate included for the customer's convenience.

Numerous important modifications have been made in terminal markings and vector diagrams. The letters P, Q, and R, K, L, and M and T for marking line terminals of windings have been replaced by A, B, and C with appropriate suffixes. The vector diagrams, marking of terminals, &c., are set out in detail in three separate figures, which now include a winding diagram of connections similar to, but more detailed than, the arrangement in the V.D.E. Rules. This is helpful in checking transformer connections, especially where parallel operation is required. These diagrams represent the relative physical positions of the terminals, and it is particularly desirable that these should be standardised to avoid difficulty when paralleling transformers.

Insulation Strength and Voltage Stresses

It is stated that it is desirable to ensure that the strength of the insulation of parts within the transformer tank against impulsive voltage stresses shall be greater than the sparkover voltage limit of the bushings under the same type of impulsive stresses. It is not always appreciated that if the flashover values of the high-voltage insulators are increased, then the insulation strength of the transformer must be correspondingly increased for satisfactory operation of the whole plant.

In the latest proposed transformer standards of the American Institute of Electrical Engineers are tables relating the rated circuit voltage, the corresponding insulation levels where these differ from the former, the equivalent arcing gap for the bushings, and finally the dry, wet and impulse (1.5×40 microsecond positive wave) flashover values of the bushings to be used with the transformers. Values have also been suggested for standard insulators in a paper read recently.[2]

Impulse tests have been incorporated for some time in the standard transformer specifications of the V.D.E. and in the draft specification of the International Electrotechnical Commission, while a further special specification dealing with impulse testing was issued by the V.D.E. in 1934.[3] In America the proposals of the transformer sub-committee have been followed, and the largest transformers for the highest voltage (such as the Boulder Dam units) are subjected to impulse tests before installation. There seems to be a lack of agreement as to the magnitude, wave-form, polarity, and time of application of the surge voltage to be applied; a convenient résumé of these differences has recently been made.[4]

In this country opinion appears to be divided as to the advisability of incorporating an impulse test as a routine or acceptance test for power transformers. It is urged, on the one hand, that since transformers are subjected in service to lightning surges it ought to be demonstrated that each transformer will stand up to these conditions before being put into commission. On the other hand, although an impulse test is agreed to be desirable, it is recommended that this should take the form of a type test rather than a routine test, and in this way the customer still receives the necessary assurance that the transformer he has ordered will withstand lightning surges other than direct strokes on an unprotected line.

Damage Due to Impulse Tests

One of the chief difficulties is that of detecting damage to the insulation of the transformer after it has been subjected to an impulse test. A typical form of breakdown consists of small, clean pinhole punctures in the insulation between turns or layers, and although various methods employing microphones or stethoscopes during testing have been suggested, the only absolutely reliable way of determining whether breakdown has occurred is to unwind and inspect very carefully the whole of the conductor in the coils. This obviously does not lend itself to routine testing. Further, the present state of knowledge of the magnitude and nature of lightning surges occurring on transmission lines is anything but complete.

Nevertheless, some form of standard type impulse test for transformers should be formulated as soon as possible, even if only in a tentative form which could be modified from time to time as progress in knowledge and technique is made. A complete summary of the present information available on impulse testing, with special reference to its application to transformers, is made in two papers which were read before the Institution of Electrical Engineers last year.[5] [6]

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[1] "The Thermal Rating of Transformers." E. T. Norris. *Journal* I.E.E., 1928, Vol. 66, p. 841.
[2] "Standardisation of Impulse-Voltage Testing." T. E. Allibone and F. R. Perry. *Journal* I.E.E., 1936, Vol. 78, p. 257.
[3] Leitsätze für die Prüfung mit Spannungsstössen. V.D.E. 0450/1933.
[4] Elektrotechnische Zeitschrift, Vol. 58, p. 41, No. 2, 1937.
[5] "The Effects of Impulse Voltages on Transformer Windings." T. E. Allibone, D. B. McKenzie and F. R. Perry. *Journal* I.E.E., 1937. Vol. 80, p. 117.

Meetings and Discussions

The control of the temperature in a small space to a thousandth of a degree Centigrade was described by Mr. L. B. Turner at the I.E.E. on Wednesday. He suggested that application on a considerably larger scale was practicable. The use of electrical methods in metallurgical research formed one aspect of a group of papers submitted at the recent annual meeting of the Iron and Steel Institute. During the past year the membership of the I.E.E. rose by 611 to about 17,400; the annual report presented yesterday was a record of increasing activity.

Isothermal Chambers

APPARATUS capable of regulating with great precision the temperature inside a small chamber is employed in various forms by radio engineers, biologists and other scientific investigators. The design of a chamber of this sort, which is mains operated and automatically maintained constant to one-thousandth of a degree Centigrade, is explained in a paper by Mr. L. B. Turner (Engineering Laboratory, Cambridge University) which was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on Wednesday this week.

Following a study of principles in electrical thermostat design, attention is confined to temperature-sensitive elements of the Wheatstone bridge configuration and the relations of the factors that determine the residual inconstancy of temperature are analysed.

Among the conclusions reached by the author are that (*a*) hunting does not depend on the heat capacity of the chamber; (*b*) the residual inconstancy does not depend on thoroughness of thermal insulation of the chamber; (*c*) there is a single figure of merit measuring the intrinsic effectiveness in resisting changes of ambient temperature and of supply voltage; (*d*) of these two factors, the former is of less practical importance than the latter; (*e*) the effect of temperature-difference between the chamber and the temperature-sensitive element must not be ignored; (*f*) identification of the temperature-sensitive resistor with the resistor carrying the controlled current, advocated by some previous workers, is wrong in principle.

The author's outfit consists of an aluminium alloy pot with a well-fitting lid. Two resistor coils lie in a helical groove cut in the external surface of the pot. These master coils extend over the middle portion of the cylinder and are screened by a wire covering that is connected to the chamber and to earth. Their resistances are almost equal at the operating temperature of the chamber, which is about 50 deg. C., but their ratio changes 3.03 parts in a million per "millideg" change of chamber temperature (a "millideg" is one-thousandth of a deg. C.). Together they are the temperature-sensitive element of the thermostat (master coil) and they form two arms of a Wheatstone bridge, whose other two arms consist mainly of two fixed external resistors which are nearly equal and retain a constant ratio despite changes in their common temperature.

All resistors are constructed non-inductively and the bridge is balanced by a condenser. Out-of-balance p.d. from the bridge is led, *via* a valve amplifier, to a translator which comprises a gasfilled output valve controlled by a vacuous input valve. The output of the translator is alternately nearly nothing (when the chamber is too hot) or the half sine-waves of current from the gasfilled valve (when the chamber is too cold). The current passes through a slave coil wound non-inductively around the chamber and the master coil.

The chamber is contained in a cylindrical canister, the space between them being insulated with glass silk. The canister is, in turn, fixed in a wooden case and has a heating coil wound non-inductively upon it. Intermittent heating by this coil is controlled by a simple bimetallic-strip contactor, and a gas-filled valve (which ignites only when the contactor is closed) holds the temperature of the canister between the limits of 5 and 25 deg. C. Alternate slots in the inner pot are occupied by an exact duplicate of the master coils. This is used as the temperature-sensitive arms of a bridge constituting an electric thermometer.

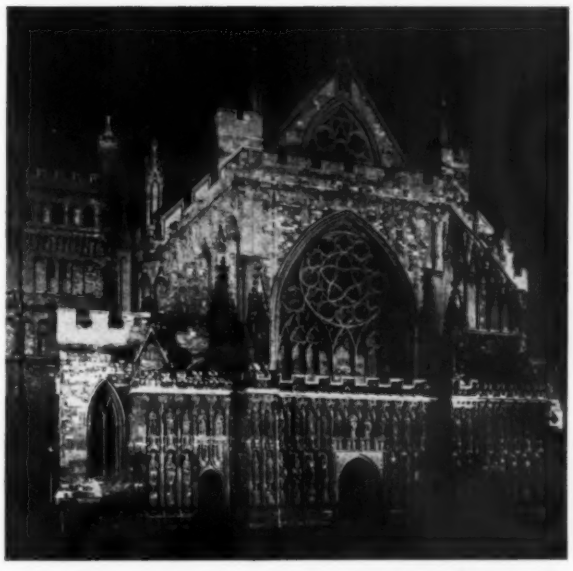
A feature that may be convenient in some applications is the rapidity with which this type of chamber can be started up from cold. For quickly heating it provision is made to apply the mains current directly to the slave coil (40 W). There appears to be no obstacle to obtaining a like performance with widely different size and temperature, if not shape. The power turned on and off in the present slave coil is about 5 W. This could be increased tenfold without any alteration of the present translator. For a given pattern of chamber and insulating jacket, the heating power required for any specified temperature is proportional to the linear dimensions.

With the present amplifier and translator, the same performance could be given with a chamber of 1,000 times the present volume. There is, however, no difficulty in augmenting the power indefinitely; the output from the present translator can be used, not for heating the chamber directly, but for controlling the grids of a bank of other gasfilled valves whose anode circuit delivers the heating current. This has been actually demonstrated by the author on a small scale, namely with two "Osram GT1" valves delivering some 250 W. A chamber with linear dimensions fifty times greater than the present apparatus has an internal volume of over 2,000 cu. ft., the size of a room. If it were profitable so to do it would be practicable to transport apples from Australia at a temperature held constant to 1 "millideg." Alternatively, greater power could be used to heat a furnace of moderate size to a high temperature if it were constructed of appropriate materials.

Iron and Steel Investigations

A NUMBER of the papers submitted for discussion at the annual meeting of the IRON AND STEEL INSTITUTE in London on April 29th and 30th indicate how electrical methods assist experimental technique in metallurgical research.

For instance, in an investigation of the iron-carbon constitutional diagram Dr. F. Adcock (National Physical Laboratory) has prepared alloys by melting pure iron in the presence of the required small amount of carbon, *in vacuo*, by means of a valve-energised high-frequency furnace. He describes how the melting chamber has a water-cooled earthing screen to protect the melt from electrostatic induction. The provision of an electrically conducting heater sleeve around the crucible helps to secure uniformity of temperature in all parts of the melt. This condition, essential for accurate thermal analysis, could not have been readily achieved by direct inductive heating. The use of a cylinder formed of several



The well-known West Front of Exeter Cathedral floodlighted with equipment by Siemens Electric Lamps & Supplies, Ltd.

complete turns of tungsten wire gauze tightly bound with tungsten wire permits the making up of alloys to an exact composition without gain or loss of carbon. The furnace is continuously evacuated by a two-stage mercury-vapour diffusion pump, and platinum/platinum-rhodium thermocouples enclosed in gas-tight sheaths of alumina have been used at temperatures up to 1,600 deg. C. for a short time without contamination, checked by the gold wire method after each experiment.

In the course of investigating the allotropy of iron Herr Hans Esser (Aachen, Germany) uses a tungsten wire vacuum furnace for melting tungsten alloys, all the parts enclosing the vacuum being water cooled. For melting chromium and silicon alloys he employs a carbon spiral vacuum furnace fitted with a device whereby the crucible can be placed in the furnace without breaking the vacuum, after high temperature degasification has been completed. To avoid carbon entering the

Very Fine Temperature Control
Electricity in Metal Research
Progress of the I.E.E.

crucible from the spiral a protecting sheath is suspended inside the latter from above, so as to surround the top edge of the crucible while leaving the remainder of it exposed to direct heating. A paper by Dr. Sven Brennert (Stockholm, Sweden) describes a new method of testing the resistance (and providing numerical values thereof) of stainless steels to local corrosive attack that causes pitting. The method consists in the determination of the anodic potential which can be applied to a metal surface without any "break-through" taking place, this potential being measured against that of a saturated calomel electrode.

The theory of the method is that the resistance of stainless steels to corrosion is due to the fact that the metal surface is covered by an oxide layer of great chemical resistance (is passivified). If this layer is strong enough to withstand the pressure of the metal ions it will form a protection and no corrosion will take place. If, on the other hand, it cannot support the solution pressure, but is broken through in one or more places, corrosion will take place at these points. In cases in which the layer is not broken through it is, nevertheless, possible sometimes to produce corrosion by anodic treatment of the surface. The break-through first occurs at a potential which is, for a certain material, always fairly constant, provided, of course, that the material is homogeneous. This "break-through potential" is a measure of the resistance of the material to corrosion.

Two Haigh electro-magnetic fatigue stress testing machines of 30 cwt. capacity, operating at a cyclic frequency of 2,200 per minute and fitted with special axial-loading devices, have been employed by Dr. H. J. Gough and Mr. D. G. Sopwith (N.P.L.) in their endeavour to ascertain the influence of the mean stress on the resistance of metals to corrosion fatigue.

In another paper the same two authors describe the results of tests which they have conducted at the N.P.L. and the Royal Aircraft Establishment, Farnborough, to ascertain the suitability of various protective coatings for steel (wire) subjected to alternating stress in the presence of salt spray. Galvanising, sherardising and sprayed aluminium plus enamel afforded a very satisfactory degree of protection. Zinc or cadmium electroplating and sprayed aluminium alone gave a fair degree of protection. Phosphate treatment plus enamel and enamel alone were better than uncoated material, but not nearly so good as the metallic coatings. Both oil and enamel reduced the degree of protection afforded by cadmium plating.

A new electrical method employed by Dr. H. A. Miley (Metallurgical Laboratories, Cambridge University) has enabled him to obtain fresh values for the thickness of the oxide films which cause the interference colours on iron when gently heated in air. He measures the millicoulombs of electric current needed for the cathodic reduction of the oxide on a specimen immersed in ammonium chloride. This reduces the insoluble ferric to a ferrous oxide, which dissolves readily.

If a current of constant strength is used, it is only necessary to observe the time which elapses before the end-point is reached, and the number of millicoulombs is obtained by simple multiplication; such a constant current is obtained by using an e.m.f. high compared with any e.m.f. (positive or negative) furnished by the experimental cell, and interposing a series resistance high compared with that of the cell itself. The end-point is indicated by noting the change in the potential drop over the cell when this constant current passes through it. This potential drop depends on the ohmic resistance of the film as well as on the energy changes involved in the reactions proceeding (*i.e.*, reduction of oxide and subsequently evolution of hydrogen).

The Institution Report for 1936-37

THE report of the council of the INSTITUTION OF ELECTRICAL ENGINEERS for the year ended March 31st, 1937, as submitted at the annual general meeting yesterday (Thursday), shows the membership to be 17,399, a net increase of 611. Not quite half the total are corporate members (fifteen honorary) and during the year newly elected members numbered 1,304, while 35 were reinstated and 754 were transferred from one class to another. There were 197 resignations, 93 deaths and 438 memberships lapsed.

A new rule permits a member of any class to cease payment of further annual subscriptions on attaining his fiftieth year of membership; twenty-two members are eligible. This recent decision is supplementary to existing rules which enable subscriptions to be compounded, or remitted in the case of members who are sixty years of age and have retired from the practice of their profession or business.

During 1936 there were 630 candidates for graduateship examinations held in nine towns at home and in ten countries overseas. In addition, 333 holders of national certificates in electrical engineering were examined in English only, while thirteen candidates over thirty years of age were permitted to fulfil the educational requirements by the submission of approved papers on theses in lieu of the examination. Seven scholarships were awarded.

During the year 530 meetings were held by members, the Council and various committees. The average attendance at ordinary meetings in London was 262, compared with 246 in the previous year, and additional to seventy-two as against eighty-five at the informal meetings. Last session a sub-centre was formed in Northern Ireland to operate directly under the Council. Papers were read and social gatherings held at local centres in the Argentine and China, and also arranged by local committees in New South Wales, Queensland, Victoria, Western Australia, Ceylon, Bombay, Calcutta and Lahore.

The Wireless Section membership is 860 and the average attendance at its meetings was 151 as compared with 196 in the previous year, apart from 137 (compared with 280) at the Section's informal meetings. The Meter and Instrument Section membership is 669 and the attendance 105 compared with eighty-one. The Transmission Section membership is 1,662 and the average attendance was ninety-five, compared with eighty. The aggregate membership of the nine Students' Sections is 4,010, including 1,851 graduates up to the age of twenty-eight years.

During the year 494 books and pamphlets were presented to the reference library and 103 volumes were purchased. The total number of readers for the year was 6,781, of whom 602 were non-members, compared with 7,517 and 593. To the lending library seventy new volumes were added and 2,963 books were issued to 1,224 borrowers, compared with 3,384 and 1,317. Local technical libraries are now in existence at ten provincial centres.

A special sub-committee has been appointed to investigate the proper maintenance of the electrical equipment of ships, and the responsibilities, general qualifications and status of sea-going electricians.

The assets of the I.E.E. benevolent fund, to which 30 per cent. of members subscribe, amount to £27,372. Donations and subscriptions in 1936 totalled £3,041, plus £353 received as gifts from dances in London and the provinces and a donation of £105 from the Association of Lancashire and Cheshire Electricity Undertakings. In 1936 grants were made to seventy-three persons, amounting to £3,720. In assisting these cases the fund also provided for the necessities of eighty-six dependents. The expenditure is rapidly approaching the total revenue of the fund.

For the year ended December 31st, 1936, the surplus of the I.E.E. revenue account was £3,113, compared with £6,087 in 1935. The surplus of assets (including investments at £139,477, none of which were made during 1936) over liabilities was £208,674, which represented an improvement of £1,969.

The I.E.E. in Ireland

The first conversazione of the new Northern Ireland Sub-Centre was held recently in the Grand Central Hotel, Belfast. The guests, who were received by Mr. T. T. Partridge (chairman) and Mrs. Partridge, included the Rt. Hon. J. M. Barbour, Minister for Commerce; Mr. F. H. Whysall, vice-chairman of the N.I. Sub-Centre, and Mrs. Whysall; Mr. W. J. M'C. Girvan, hon. secretary, and Mrs. Girvan; Alderman M'Kinney, chairman of the Electricity Committee of the Belfast Corporation, and Miss M'Kinney; Mr. K. M'Master, secretary of the N.I. Electricity Board; Mr. T. G. Christie, chief engineer of the Board; Mr. Boyton, chief engineer of the Antrim Electricity Supply Co., and Mrs. Boyton; and Mr. Nixon, M.P., former chairman of the Belfast Electricity Committee. Mr. Partridge said they were delighted to have among them Mr. H. T. Young and Mr. P. F. Rowell, I.E.E. president and secretary, respectively. During the past few years the electrical industry had increased enormously in Northern Ireland, and members had encountered difficulties of time and expense in travelling to Dublin to attend meetings. It was felt that the scientific advancement of electricity was being hampered by this, and their efforts to form a sub-centre had met with support from Dublin as well as from London. The membership in Northern Ireland had risen from 77 in 1933 to 125 at present. A dance followed the reception.

At the annual conversazione and dance of the Irish Centre in Dublin there was a large assembly of guests to meet the president, Mr. H. T. Young. Mr. Warren Storey, chairman of the Irish Centre, and Mrs. Storey, received the guests. Mr. Young, in acknowledging the chairman's welcome, said that the Irish Centre was one of the first three local centres to be established some 40 years ago. Those present included Mr. P. F. Rowell, secretary, and Mr. R. N. Eaton, hon. sec., Irish Centre; the Minister for Finance and Mrs. McEntee; the Belgian Consul General; the French Commercial Attaché; the German Minister and Frau Schroetter; and Mr. R. F. Browne, chairman, I.F.S. Electricity Supply Board.

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Improvement in Urban Transport

At the conference of the Municipal Tramways and Transport Association at Bournemouth last year much stress was put on the disorganisation caused to the tramway and trolley-bus traffic due to the parking of private cars in main thoroughfares, and this subject has again received a great amount of attention due to Mr. Hore-Belisha's recent pronouncements and suggested prohibition of parking.

The following suggestion, in addition to facilitating cross-road traffic, provides for a continuous flow for through traffic (this being better than the present signal scheme), parking places in the middle of the town, safety for pedestrians, and an increase in rateable and site values by increasing front-window space at busy crossings.

Briefly, the idea is to convert each crossing into a roundabout by utilising side streets or, where these are not available, to cut an arcade through the buildings so as to make a complete roundabout. Such roundabouts every mile along main thoroughfares such as Oxford Street, London, or Deansgate, Manchester, would provide a parking place for 200 to 250 cars per crossing.

Consultations with architects have shown that the construction of the arcades would be a simple engineering matter. The best customers—motorists—would be brought to the locality, and the value of increased shop-window space in the arcades would go a long way towards paying the cost of the arcades. No satisfactory method of parking of cars at anything like the same cost has yet been found, and the scheme would benefit the business community.

H. COBDEN TURNER, M.I.E.E., M.I.Mech.E.

Salford, *April 28th.*

A part of the Central Hall, Westminster, floodlighted by means of Holophane equipment and one of the fountains in Trafalgar Square illuminated by amber-coloured submerged "Ediswan" projectors *[Elec. Rev. photos.*

Static Electricity

Mr. Elwess's letter on static effects which he experienced in the U.S.A. is interesting. I wonder whether he found these effects more marked the higher he rose above sea level?

I have recently returned from wandering round South America. Although I myself never experienced any abnormal static effects—not even in La Paz, Bolivia, 12,000 ft. above sea level—I was assured by numerous people that static phenomena in some of the mining camps and *oficinas*, high up in the Andes, are most marked. I was told one constantly experienced a peculiar "charged" effect, and that distinct shocks upon touching things and persons, and clearly visible sparks from the finger tips, were quite common.

Mr. Elwess wonders whether the "pep" of the American people is due to the atmosphere being highly charged with electricity. The Andes atmosphere certainly is so charged, but life there is trying rather than invigorating. Nervous breakdowns are by no means rare. However, that may be due more to the rarefied atmosphere than to the statics.

Doncaster, *May 1st.* CECIL C. HIGGENS.

The phenomena encountered by your correspondents are due purely to static electricity since the potential of all wiring must be anchored at the voltage to earth by the supply undertaking.

The generation of static electricity is by frictional separation of opposite electrical charges and, in general, if two bodies are rubbed together the one whose particles are the more easily removed by friction becomes negatively charged.

It is doubtful, however, whether friction is actually the cause, since the electrification produced is not proportional to it. When two different substances with their surfaces in contact are drawn apart, they are found, if one or both of them are insulators, to have taken up opposite charges. The work done in overcoming the attraction of these opposite charges on separation appears as a store of electrical energy.

The condition for the accumulation of large charges on one of the bodies due to continued friction is a high insulation resistance between the two; otherwise current would flow and the charges would be neutralised. In the dry, electrically heated atmosphere of a modern flat this condition is liable to occur, as the body becomes charged and an equal and opposite charge occurs on the walls of the room. This can be overcome by spraying the carpet and floor with a solution of a deliquescent salt such as calcium chloride.

Readers may have received shocks from the static electricity generated by steam issuing from the boiler of a rubber-tyred steam lorry. Sparks of considerable length have been obtained from a row of spikes placed in the path of steam jets issuing from wooden nozzles.

P. A. SPURR, B.Sc. (Eng.).

Coventry, *April 30th.*

The Approach to Electrical Design

I am grateful to Dr. Chapman for his comments on my article on this subject, and with the first part of them I am in close agreement. Quotation, I know, is always dangerous and I think, on reflection, that I might have been well advised to comment on the "approach" of his book entirely in my own words, rather than select (for brevity) a part of his preface which seemed to me to illustrate the trend of the book. But if I concede this tactical error, I would still hold that the book is, in the large and judged by the points which it emphasises, a discussion of what I have defined as "an artificial system."

A reader might gather that the main items in the mental outfit of an induction-motor designer were the mathematical proofs, based on somewhat unreal assumptions, of the rotating-field theory, the harmonic analysis of the windings, and the circle diagram. In addition the treatment has an appearance of exactness owing to the extensive use of mathematical notation.

In the last quarter or so of the book such things as the effects of saturation and slot harmonics are discussed; but I believe many people have been left with the impression that these are small in size and importance compared with the original theory. One cannot help wondering whether so exact and full an initial analysis is justified, when such radical modification is afterwards necessary to harmonise it with practice.

As for principles being "eternal," I would only say that one cannot conceive what would happen to electrical design if the laws of electromagnetic induction or heat flow were somehow to be abrogated. Perhaps Dr. Chapman dislikes the theological flavour of the word "eternal," and would prefer "permanent."

In conclusion, I should like to say that I chose Dr. Chapman's book as an example only because it is well known and typical of its class and not because I desired to single it out for unfavourable criticism. G. H. RAWCLIFFE.

Gloucester, *April 30th.*

Price Reductions Bring Business

I am sending you the following figures because I think they provide an excellent object lesson to undertakers who are shy of reducing tariffs. In my opinion they are all the more striking because the Welwyn Garden City Company had already achieved a considerable measure of saturation. For example, at the end of the March quarter, 1936, 46.7 per cent. of the domestic consumers were cooking by electricity, which figure was raised to 54.3 per cent. at the end of the March quarter of 1937.

At July 1st, 1936, the company made a drastic reduction in the tariff, the follow-on rate in the two-part tariff being reduced to 4s. per 100 kWh all the year round, whereas previously this follow-on rate had been 1d. per kWh in the winter quarters and 1d. per kWh for the first 200 kWh, with ½d. for all kWh in excess of 200 in the summer quarters. On the prepayment scales the follow-on rate was 1d. per kWh all the year round, but the fixed charge was lower.

When the reduction was made prepayment consumers were given the option of taking units at 4s. per 100 with a higher fixed charge than hitherto or, alternatively, remaining on the existing fixed charge with a follow-on rate of ½d. per kWh. Actually, at the end of March, 1937, approximately 47.5 per cent. of the prepayment consumers were taking their supply at the lower rate.

In preparing the table I have included the whole of the domestic consumers, but at the end of March, 1936, 41 ordinary consumers and 254 prepayment consumers were taking supply at the lighting flat rate; these figures were reduced by March, 1937, to 27 and 168 respectively.

The significant point, of course, is not the actual increase in the total kWh sold, but the increase of some 30 per cent. in the average consumption, an improvement which, in my opinion, is rather astounding when it is considered that the starting figure was already above the average. I think, too, it will be conceded that weather conditions during the quarter were not abnormal.

Item.	By ordinary meter.	By prepayment meter.	Total domestic.
1. kWh sold :			
March, 1936	656,549	300,083	956,632
„ 1937	882,528	465,596	1,348,124
Increase per cent. ...	34.4	55.1	40.9
2. Consumers connected at end of quarter :			
March, 1936	1,258	1,620	2,878
„ 1937	1,289	1,793	3,082
3. kWh sold per consumer :			
March, 1936	522	185	332
„ 1937	684	260	437
Increase per cent. ...	31.0	40.5	31.6

A. T. BULLEN, *Electrical Engineer,*
Welwyn, *May 1st.* Welwyn Garden City E.S. Co., Ltd.

The I.E.E. in Kent

THE annual one-day summer outing of the Transmission Section of the Institution of Electrical Engineers took place in fine weather on Saturday last. Ladies formed quite half the party of 150 which travelled in five motor coaches down to Gravesend and there toured various sections of the group of factories comprising the Gravesend works of W. T. Henley's Telegraph Works Co., Ltd.

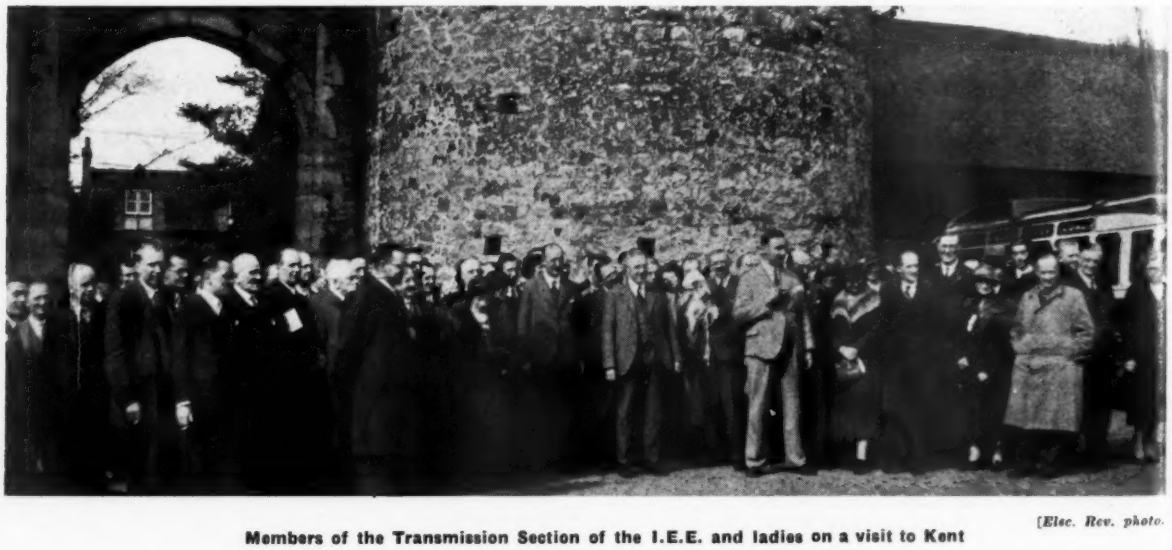
While a limited number inspected the research department, most of the visitors were conducted in turn through the wire-drawing shops, the paper-insulated cable factory and the rubber works. In the last-mentioned, apart from the main business of manufacturing pneumatic tyres for motor vehicles, and tennis balls, a large section is at the moment busily engaged upon the production for the Government of large quantities of gas masks.

The party partook of luncheon as Messrs. Henley's guests at the Co-operative Hall, Gravesend. The chair was occupied by Dr. P. Dunsheath, who, in his dual capacity of chief engineer of Henley's and chairman of the I.E.E. Transmission Section, both welcomed the visitors and also thanked the company for its generous hospitality.

The toast of the "Transmission Section" was proposed by Sir Montague Hughman, chairman of the company, who reminded the gathering that this was Henley's centenary year. They had done a record amount of business, employed more people than in any other year, and, incidentally, made more profit than ever before. Transmission engineers, said Sir Montague, would sooner or later have to put their lines underground, and when they did so Henley's would be ready to lay the cables. The toast was responded to by Mr. J. L. Eve, vice-chairman of the Section.

Another centenary is that of the "Pickwick Papers," which Charles Dickens started writing just a hundred years ago. It was therefore appropriate that the party should spend the afternoon touring part of the "Dickens country" under the genial guidance of Lieut.-Col. W. L. Gadd, of the Dickens Fellowship.

At Chalk is the wooden cottage in which Dickens spent his honeymoon in 1836 and also the original of Joe Gargery's forge, referred to in "Great Expectations," Lower Higham being the village round which the story was written. After an inspection of Cooling Castle the party went on to Cobham, where tea was served at the "Leather Bottle," which contains many interesting Dickensian exhibits. The ancient alms-houses and the church (which contains what are probably the finest monumental brasses in the country) are interesting features of Cobham. On the way home a halt was made at Gadshill Place, Dickens's "Kentish Freehold" (now a girls' school), which he occupied from 1860 until his death in 1870.



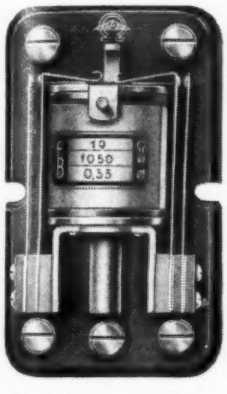
[*Elec. Rev.* photo.

Members of the Transmission Section of the I.E.E. and ladies on a visit to Kent

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Two-step Relay



The "Londex" relay

The model "TSR" relay introduced by LONDEX, LTD., Brettenham House, Lancaster Place, Strand, W.C.2, is simple in construction and has no mechanically operated parts.

Directly the coil is excited both cores are drawn into the centre of the coil or magnetic field. The insulated upper part of the upper core is then held fast in the top position and, at the same time, the relay contacts are closed. If the current exciting the coil is cut off the lower part of the core drops down, whereas the top half remains fixed. When the coil is excited again the lower core is not attracted owing to its being too far removed from the field, but the upper core is pulled down and will return to its original position, thus opening the contacts.

This new remote-control relay can be fitted with one or several contacts for circuits to be closed, opened or changed over. The energising current required is about 4 VA, a.c., or d.c., and the contact load may be up to about 300 VA. For heavier loads mercury contacts have to be employed.

According to the same principle time-lag devices can be incorporated, and the relay can also be used as a measuring relay, sensitive to potential or current fluctuations.

Another new development is the "Nora" wattmeter, with a range of 0-180 W, designed specifically for use with radio receivers.

A "Floodlighted" Fire

In the new "Sunglade" fire of the ARTIC FUSE & ELECTRICAL MANUFACTURING CO., LTD., Birtley, Co. Durham, the elements are focused in a special discontinuous louvred reflector which is floodlighted from behind, the whole fire appearing as a glowing red mass when seen from any angle. A chromium-plated reflector with a tubular floodlighting lamp is incorporated, and the measurements are: height 20 in., width 16¼ in., and depth 10 in. Single or double elements give optional ratings of 1¼ kW, 1½ kW, 2½ kW or 3 kW, a switch being fitted to the 2½ and 3-kW models.

The "Sunglade" fire

An Alarm Kettle

The "Monica" electric kettle, developed by BEST PRODUCTS, LTD., Felix Works, Felixstowe, gives an audible warning as soon as it boils, besides switching off the element should the water level become dangerously low. The latter operation is effected by the melting of an alloy, allowing the spring-loaded connector to be ejected. It can, however, be reset immediately without replacing any parts. The loadings of the various sizes (2 to 6 pints, 700-1,800 W) enable boiling to take place within eight minutes for each size. Both the handle and the feet are heat-insulated, the body being constructed of heavy-gauge aluminium, while three-core flexible and an earthed connector are fitted.

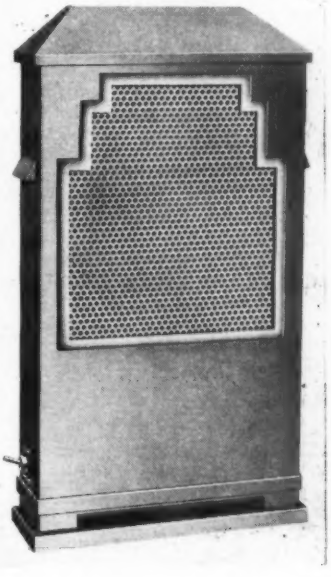
"Philplug" Compound

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, announces that arrangements have now been completed with Philplug Products, Ltd., Aintree Road Works, Perivale, Greenford, for the distribution of "Philplug" products.

"Philplug" is asbestos specially treated to render it plastic and containing anti-corrosive material. It is supplied in dry form and when required for use it is moistened and worked in the hands to form a plug of putty-like consistency. This plug having been rammed hard and pierced down the centre, the screw can be immediately inserted and the full load taken without waiting for the material to dry. It does not depend on pressure for its grip, but makes a positive cohesion with the material surrounding it. The character of the material enables the same boring tool to be used for many different sizes of screws. Philplug products also include a range of patent anchor bolts, with a comprehensive line of masonry drills and jumpers.

A Convector Heater

A low-temperature convector heater is the latest development by BERKELEY & YOUNG, LTD., Tyseley, Birmingham, 11. The casing is of steel and the elements, which are enclosed, are of the spiral type supported at intervals of ⅜ in. by refractories. The maximum loading is 1 kW, at which the element operates at a black heat; a switch enables the loading to be reduced to 500 W. To give an impression of warmth a moving flame-coloured light is incorporated. The weight is 22 lb. and the finishes available are neutral, blue and gold, matt silver and matt gold.



The B. & Y. convector heater

Flood and Spot Lighting

GRAHAM FARISH, LTD., Mason's Hill, Bromley, Kent, are now supplying their flood and spot lights in other finishes besides Coronation colours. These units, in gold and similar finishes, are eminently suitable for shop window and showroom lighting.

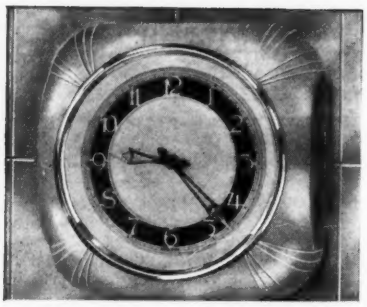
An Arc Solderer

A pencil-type solderer offered by RUNBAKEN PRODUCTS, 280, Deansgate, Manchester, 3, employs an arc to melt the solder. The workshop model will operate from a car battery, although an a.c. mains model is also made. The carbon electrode is easily renewable.

Air Heater and Humidifier

An electric heater with quietly running fan and motor mounted behind it to give forced air circulation at a fixed temperature has been developed by AIR CONDITIONING & ENGINEERING, LTD., 4-12, Palmer Street, S.W.1, under the name

Three artistic table standards designed by Waite & Son, Ltd.

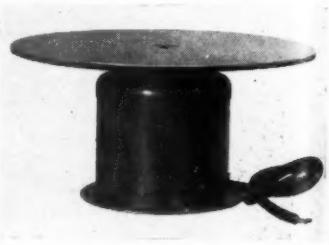


A new clock for wall mounting in the kitchen—the "Durban"—introduced by Smith's English Clocks, Ltd.

of the "Zephaire" unit heater. The humidifier operates automatically with increase of temperature. The rapidity with which the moisture is released from the container depends upon the temperature and humidity of the air surrounding the outlet pipe. The unit is rated at 1 kW.

A Display Turntable

A device which should be of interest to shopkeepers is an electric turntable which has been designed by NATHAN & ALLEN, LTD., 131, Victoria Street, London, S.W.1, for shop-window advertising displays, &c. It has a 10-in. top rotating twice per minute and taking a weight up to 22 lb. Electricity consumption amounts to only 2 W. The device, which is supplied complete with flex, is available for a.c. only.

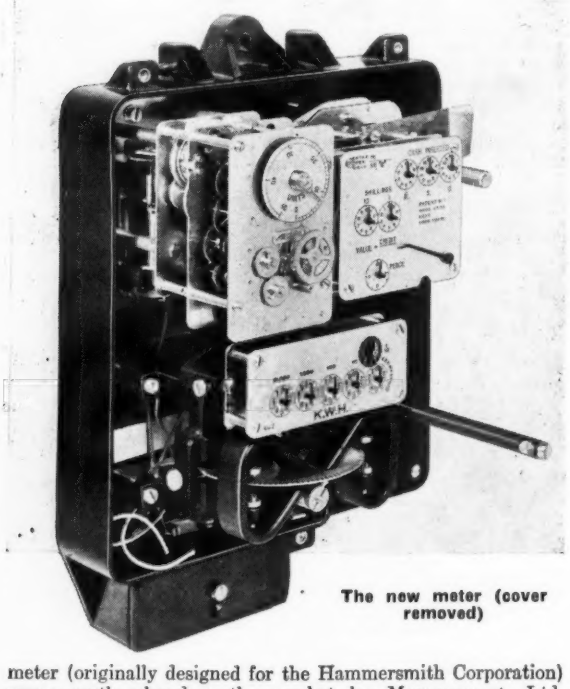


The Nathan & Allen turntable

Time-controlled Step-rate Prepayment Meter

ORDINARY two-part tariff electricity meters demand that both fixed and running charges be paid in advance, which is not always convenient to consumers, who are usually wage-earners. Accordingly, the step-rate instrument was devised, consisting of the addition to a standard prepayment meter of special mechanism which provides for a definite predetermined number of kWh to be charged for at a high price and all further kWh consumed within a definite period to be charged for at a low price. The period is determined by the collector emptying the cash box, which, when withdrawn, automatically resets the meter for the high price per kWh. Although the time over which the fixed charge—that is, the difference between the high price and the low price per kWh multiplied by the number of primary kWh—is collected may vary from period to period, with a carefully selected tariff the supply undertaking is always assured of this amount without ever running the consumer into debt, and the latter, moreover, has the added incentive of cheaper electricity during the remaining portion of the period.

But the ordinary step-rate prepayment meter, although presenting certain advantages, still does not satisfy all the conditions when considering the weekly wage-earner. It was with this object in view that a time-controlled step-rate prepayment



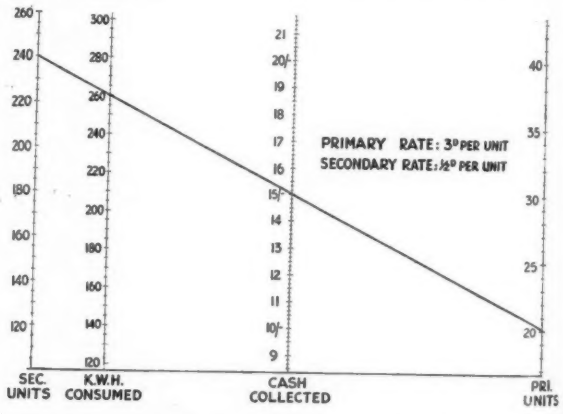
The new meter (cover removed)

meter (originally designed for the Hammersmith Corporation) was recently placed on the market by Measurement, Ltd. This type is, in reality, just an ordinary step-rate prepayment meter fitted with a small self-starting synchronous motor to effect automatic weekly resetting. If desired the resetting can be effected daily, monthly or quarterly, as the consumer may find it most convenient to meet his obligation.

The design of the Measurement multi-coin prepayment meter has made it possible to incorporate a time-controlled step-rate unit in the standard product. The meter is contained in an all-insulated case and can be arranged for triple, dual, or single coin operation. Apart from the usual dials, a primary kWh dial is fitted at the front, the setting of which can be observed through a window when the cover is in position.

The number of predetermined primary kWh can be varied on site, depending on the rates per kWh and the amount of fixed charge to be collected. The change wheels for the primary and secondary rates can be seen below the primary kWh dial. A small indicator is also visible from the front to show whether the meter is on the primary or secondary rate. The change-over from primary to secondary rate is, as mentioned, controlled by the setting shown on the primary rate unit, and takes place automatically when the pointer of the primary kWh dial points vertically downward in line with the centre marking on the rate-indicator plate.

The resetting mechanism is driven by the low-consumption Measurement synchronous motor, which has the sole function of loading up a spring contained in a barrel the outside of which shows time divisions. With a weekly resetting this barrel makes one revolution per week and is divided into seven days, each day being sub-divided into four equal intervals. Two small indicators are situated on each side of the



Section of the checking nomogram

barrel, one indicating the time and day at which the resetting takes place, the other the actual time and day. Resetting takes place when these two indicators are exactly opposite one another, the energy stored in the spring being released to reset the primary kWh dial to zero and change over the rate and rate-indicator to the primary position.

A small round window is provided at the side of the cover through which the time dial can be observed. The resetting time can be easily adjusted and provision is also made for driving the barrel by hand in order that the time dial may be set at the time the meter is to be connected. This also permits manual testing of the resetting mechanism.

Only the total energy, whether consumed on the primary or secondary rate, is recorded on the kWh dial, but a definite relationship exists between the amount of money collected, the total kWh consumed and the number of kWh supplied at each rate. The number of primary kWh to be consumed per week should be such that at all times of the year the consumer can reasonably be expected to use an amount of kWh in excess of the setting. If this condition is fulfilled, then the kWh consumed at each rate can easily be ascertained. For checking purposes the number of kWh consumed at each rate can be ascertained from a nomogram, a section of which is illustrated. A straight-edge laid across the diagram so as to join the kWh consumed and the money collected will indicate on the extreme left-hand and right-hand scales the kWh consumed on the secondary and primary rates, respectively.

New Books

The Protection of Electric Plant. By P. F. STRITZL. Pp. 200; figs. 193. London: Sir Isaac Pitman & Sons. Price 18s.

The object of this book, as the author explains in his preface, is to describe protective methods which have been mainly developed abroad. Had this been indicated in the title and followed consistently, the value of the book would have been increased to British engineers. Methods developed in Germany are dealt with in about four-fifths of the book, and the inclusion of a few non-German systems prevents the work being either a self-contained account of development in one particular country or a comprehensive account of modern methods of protection. Thus, the several British systems using d.c. pilots and the use of the negative phase-sequence components developed largely in America and France are not described. It is stated that "with regard to valve relays, no practical results are available"; yet in this country such relays have been in successful use for protection for some years.

Air-blast switchgear, the Petersen coil and German systems of distance protection, should be fully understood in this country, even though conditions do not justify their wholesale adoption here, and more space and a clearer presentation of these developments would have been all to the good. One would gather from page 69 that the objection to an insulated neutral is the substantial 50-cycle charging current which flows when a phase is earthed, but the real objection is the destructive arcing earth and its high-frequency voltage, which can be prevented both by the Petersen coil and by any other method of earthing the neutral. On page 183 it is suggested, erroneously, that fears of insulating the neutral are responsible for the non-resonating transformer, but this transformer is no safeguard against arcing earths; it is designed to meet a condition which is likely to arise with any treatment of the neutral.

The reason given on page 11 why the starpoint of three-limbed potential transformers may not be earthed is that there would be overheating in the event of unbalance. There would not; the reason is that with such an arrangement a true reading of the residual current is not obtained. The chief value of the book is in the descriptive side, where it introduces British engineers to work with which they are not so well acquainted as is desirable.

Motor Driving Made Easy. By R. F. BROAD and the Technical Staff of *The Autocar*. Pp. 133; illus. London: Iliffe & Sons, Ltd. Price 2s. 6d.

In the operation and maintenance of electrical transmission and distribution systems much depends upon the efficiency with which the fleet of motor cars is handled by members of its staff. Yet how often has urgent work been delayed by unskilful handling of cars by junior engineers and others in a hurry, not to mention the material effect on costs of transport upkeep entailed by inexperience.

This book, therefore, can be recommended to supply undertakings faced with the difficulty of training men to cope with emergency work in all its aspects, including the essential of getting out on to the job. The new (sixth) edition has been revised throughout in the light of the most recent developments in car control and changes in motoring law. Numerous illustrations show clearly what good driving implies, imparting an understanding of such points as double-declutching, steering in its finer aspects, gears, lighting and maintenance, as well as how to deal with skidding, fog and other adverse conditions likely to be met with on a journey. The series of theoretical driving lessons included should add greatly to the value of practical instruction on the road, as it enables the learner to take an intelligent interest in the wherefore of what he is told to do and thus acquire "road sense."

Electron Tubes in Industry. By KEITH HENNEY. (Second Edition.) Pp. 522; figs. 397. London: McGraw-Hill Publishing Co. Price 30s.

In the second edition of this useful work the author has introduced much new material culled from literature published since the first edition in 1934. The numerous references to the sources of much of the information, will no doubt be of considerable value both to the teacher and to the engineer who may use this volume as a guide to the extensive application of electron tubes to industrial problems. Their scope in this direction is stated by the author: "The tube can be used, often to advantage, in any case where a variation of an electrical or physical or chemical quantity occurs, for example, voltage, current, resistance, frequency, &c., or to temperature, moisture, position in space, weight, &c., and to chemical changes such as opacity, colour, turbidity, acidity, conductivity, &c. The electron tube acting alone or in combination is a useful tool: time alone will tell how important it becomes in industry."

Three main chapters deal with vacuum-tube amplifiers, gaseous triodes and light-sensitive tubes and their applications. It is evident that the author has had at his disposal not only detailed and accurate information, but also has assembled his material together in a manner which makes the book delightful reading.

One application of the cold-cathode impulse valve which has found extended use in this country and which does not receive adequate attention is in the timing circuits of traffic control systems. On the whole, however, the book is most informative and comprehensive. A feature which must give the book a position of importance among contemporary works is its suggestions of new applications of electron tube devices to particular industrial problems.

Elements of Electricity. (Third edition.) By W. H. TIMBIE. Pp. 569; figs. 469. London: Chapman & Hall, Ltd. Price 15s.

This new edition of a book that is deservedly popular in the United States has been completely rewritten and may be regarded as a new work. It yields an interesting insight into the technical education methods employed in the United States, and the author, who is Professor of Electrical Engineering and Industrial Practice in the Massachusetts Institute of Technology, as in his other books on electrical subjects, combines with the happiest of results the laws of science and the realities of industrial practice. The reader is led to feel, from the beginning, that he is dealing with the actual problems of the electrical industry and not, as is so often the case, that he is studying laws which possibly at some later stage he may apply to practical problems. Thus, the first chapter deals with Ohm's Law, and by the time the seventy-seven problems which it contains have been worked through the student has a knowledge of current values in lamps, heaters, railway cars, telephones, and so on. He can realise, too, the paradox of increasing the load and reducing the resistance, since most industrial loads represent parallel circuits. The same eminently practical method is applied in the second chapter on power and energy.

It is, of course, impossible to escape completely from theory, as, for example, in the investigation of the magnetic circuit, but the laws and their practical applications are kept in close juxtaposition, with the result that generators and motors are soon brought into the picture. In the same way, discussions on inductance and capacitance lead to the study of the problems of alternating currents, including the elementary theory and practice of alternators and the various types of a.c. motors. The final two chapters, covering vacuum tubes (which range from wireless valves and oscillograph tubes to large mercury-arc rectifiers) and the electrostatic circuit (which is of such importance in problems of high-voltage transmission), show how comprehensive is the field which the author has covered. Answers to the many problems are given in a separate booklet, which can be removed from the main volume if desired. This work can be cordially recommended, not only to students and teachers on this side of the Atlantic, but also to practising engineers, who will find a refreshing originality in the methods adopted for solving the various problems with which they are faced in their daily work.

Communication Engineering. (Second edition.) By W. L. EVERITT. Pp. 727; figs. 411. London: McGraw-Hill Publishing Co., Ltd. Price: 30s. net.

Developments in communication engineering have been so extensive since the publication of the first appearance of this work five years ago, that the second edition entailed not only a thorough revision but the addition of a large amount of new material. To find room for this, the chapters on complex quantities and frequency measurements have been omitted and about 150 pages added to the text. The matter dealing with amplifiers has been considerably expanded, and the text generally brought up to date, including the revision of many of the problems set.

The author, who is Professor of Electrical Engineering in Ohio State University, lays stress on the value of these problems as suggestive of the type which should be solvable from the treatment given in the text, and recommends the student to design others, as great value is obtained from setting up problems and assembling the data.

The volume is divided into five main parts, viz., classification of impedance elements, networks using linear bilateral impedances, networks using unilateral and nonlinear impedances, radiation, and electromechanical coupling. The main portion, over 500 pages, comes under the heading of networks. Illustrative problems and bibliographies are given at the end of chapters.

This book deals with fundamentals, and considers general, rather than particular, solutions: broad principles, rather than specific applications such as telephone switching systems. It assumes the standard of mathematical knowledge required for an engineering degree, and a knowledge of the principles of direct and alternating currents. Like its forerunner, this second edition should prove of great value for students of telecommunication, and as a book of reference for engineers who are already engaged in that branch of electrical engineering.

Industrial Electricity and Wiring. By J. A. MOYER and J. A. WOSTREL (Second edition). Pp. 502; figs. 281. London: McGraw Hill Publishing Co. Price 15s.

The authors of this book on American wiring methods have had previous successful partnership in the production of practical electrical manuals. That the work under review is well adapted to its public is evident in the early appearance of this second and revised edition.

It is based on the National Electrical Code which dominates wiring in the U.S.A., and is designed to align practice on the code requirements. Assuming no previous technical know-

ledge, the textbook has a preliminary chapter on theory and units and then proceeds to such matter as the splicing and soldering of wires. There are sections on motor and transformer wiring which convey further hints on the essentials of electrical machines, but throughout there is little attempt to penetrate beyond the requirements of practical application.

The sizes of wires (given in circular mils), the use of cartridge fuse panel boards, light flexible conduits, circular loom conveyors, wood and sheet metal runways, all present differences to the British wireman reader, but these are, nevertheless, well worthy of consideration in our country where standardisation has not perceptibly retarded progress. It is interesting to note that our Cable Makers' Association has made a definite step towards American nomenclature in adopting 600 V as a cable classification.

A short chapter is devoted to estimating and tables are provided giving average costs for installing conduit, fitting elbows, erecting boxes and fittings and drawing cables into conduits. At the end of each chapter there is a set of test questions, and in the appendix useful figures of estimated demand loads for various kinds of buildings are provided. For teachers of practical wiring classes and for contractors and their foremen the book can be recommended.

The Lead Storage Battery. By H. G. BROWN (Third edition). Pp. 202; figs. 101. London: Locomotive Publishing Co., Ltd. Price 5s.

This work, by the chief engineer of the D. P. Battery Co., is devoted to an elementary study of the fundamental principles of the lead storage battery and its applications. It has been thoroughly revised in the new edition and the matter has been expanded by about one-fifth, and additional illustrations and diagrams have been included. After an introductory chapter dealing with the chemistry of the subject, the author discusses the important features of a storage battery from the engineer's standpoint which include its voltage, capacity and efficiency. The various methods employed to produce the active material and attach it to the lead plate are all modifications of two principal systems, *viz.*, the Planté and the Faure, both of which are described in detail. The greater effectiveness of the active material in Planté plates as compared with pasted plates is more than counterbalanced by the greater weight of the soft lead casting.

In dealing with auxiliary apparatus, Mr. Brown considers boosters, regulator switches and automatic cut-outs. The sections on the charging, care, treatment and repair, and testing of cells are of much practical value and reflect the result of long practical experience. The economics of secondary batteries for buffer and peak-load work in small generating plants and for emergency lighting have been clearly worked out. It is only comparatively recently that the possibilities of electric road and industrial works traction have been fully realised, and many instances are given of the manner in which the electric vehicle is competing successfully with both steam and petrol, especially in point-to-point work over a limited area, involving constant stopping and starting.

This volume is a valuable contribution to the literature of the subject from the practical aspects. The diagrams have been well prepared and are excellently reproduced.

Shorter Notices

"Thermionic Valves in Modern Radio Receivers," by A. T. Witts. Pp. 192; figs. 114. Price 8s. 6d. "Thermodynamics Applied to Heat Engines," by E. H. Lewitt. (Second edition.) Pp. 376; figs. 120. Price 12s. 6d. London: Sir Isaac Pitman & Sons, Ltd.

"Electrical Equipment of Automobiles," by S. Parker Smith. (Third edition.) Pp. 250; figs. 105. London: Chapman & Hall, Ltd. Price 6s.

Electrical Imports of Ceylon

LAST year there was again a rise in Ceylon's imports of electrical goods, the total value being 2,604,000 Rs., as compared with 2,424,000 Rs. in 1935 and 1,728,000 Rs. in the previous year. The increase in 1936 was mainly in the lighter apparatus. The United Kingdom remained the leading supplier, the only noteworthy competition being from the United States in radio material. With regard to the future of trade generally in the island, which depends mainly on the markets for tea and rubber, prospects are considered good, the prices of these commodities having improved lately in consonance with the general world trend.

Details of the electrical trade are given in the following table, which is based on the recently issued official returns. (At par the rupee is worth 1s. 6d.):—

	1936. Rs. (000).	Inc. or dec. on 1935. Rs. (000).
Control and switchgear—		
Total*	83	+ 35
Radio instruments and apparatus—		
Total	216	+ 24
From United Kingdom	93	− 3
,, Germany	10	+ 6
,, Holland	22	+ 4
,, United States	86	+ 16
Other telegraph and telephone instruments—		
Total*	109	+ 50
Lighting accessories, fittings and switches—		
Total†	260	+ 28
From United Kingdom	90	+ 20
,, Germany	27	− 10
,, Japan	10	− 11
,, United States	40	+ 2
Batteries, Dry—		
Total	341	+ 30
From United Kingdom	3	− 31
,, United States	130	+ 9
,, Germany	2	− 2
,, Hong Kong	204	+ 45
Other batteries and accumulators—		
Total*	92	+ 45
Electrical goods and apparatus not elsewhere specified—		
Total	420	+ 13
From United Kingdom	374	+ 19
,, Germany	12	− 4
,, Japan	7	+ 1
,, United States	16	− 3
Transformers and convertors—		
Total*	55	+ 17
Generators and alternators—		
Total*	95	+ 18
Motors—		
Total*	75	+ 11
Electrical machinery not elsewhere specified—		
Total	223	− 75
From United Kingdom	167	− 119
,, Germany	6	+ 3
,, Switzerland	9	+ 9
,, United States	33	+ 18
Rubber insulated wires and cables—		
Total	136	− 54
From United Kingdom	116	− 52
,, Germany	16	− 1
Other electric wires and cables—		
Total	294	− 9
From United Kingdom	288	− 9
,, Germany	5	+ 1
Lamps, gas-filled—		
Total	77	− 2
From United Kingdom	69	—
Electric lamps, other—		
Total	57	+ 10
From United Kingdom	40	+ 12
,, Japan	6	− 4
Torch bulbs—		
Total	51	+ 17
From Japan	18	+ 10
,, United States	32	+ 6

* Mainly from United Kingdom.
† 84,000 Rs. from Hong Kong in 1936.

Japanese Overseas Trade

IN the electrical trade of Japan last year the total value of imports, at 4,924,000 yen, showed a decline of 532,000 yen as compared with 1935, while exports, at 48,881,000 yen, showed an increase on that year of 12,800,000 yen. Less than a decade ago imports of electrical machinery (alone) were greater in value than exports. Now there is a balance of over 7,000,000 yen in favour of Japan. Of the 18,600,000 yen worth of lamps exported last year, nearly 5,000,000 yen worth went to the United States, the markets next in importance being Great Britain (2,460,000 yen against 1,440,000 yen in 1935), British India (1,150,000 yen) and the Dutch East Indies (1,120,000 yen). Of insulated electric wire the approximate value taken by Kwantung was 6,000,000 yen, and by China 1,570,000 yen; and of electrical machinery 8,767,000 yen and 1,732,000 yen respectively.

There was a large decline in the imports of telegraph instruments, which is attributable to exceptionally large imports in the previous year. The chief suppliers of dynamos, transformers, &c., last year were the United States, Great Britain and Germany, which together accounted for 1,560,000 yen out of the total of 1,805,000 yen.

The figures reproduced in the following table show the value of electrical exports and imports for 1936, as compared with 1935:—

	1936. Yen (000).	Inc. or dec. on 1935 Yen (000).
EXPORTS		
Insulated wire	13,705	+ 2,323
Batteries	1,909	+ 185
Radio receivers	2,024	+ 331
Other telephone instruments	3,537	+ 163
Insulators	716	− 255
Motors and dynamos	6 457	+ 3,645
Transformers	2,018	+ 775
Switchboards	908	+ 255
Electrical apparatus not specified	6,580	+ 3,246
Miniature electric lamps for decoration	3,867	+ 1,662
Miniature electric lamps for automobiles	525	+ 57
Other miniature electric lamps	1,588	+ 216
Electric lamps not over 32 c.p.	2,069	− 23
Electric lamps not over 100 c.p.	1,564	+ 277
Other electric lamps	233	—
Electric flashlights	1,181	− 69
IMPORTS		
Insulated wire	95	− 13
Ammeters and voltmeters	90	+ 29
Wattmeters	83	+ 8
Batteries and parts	100	+ 15
Telegraph instruments	151	− 397
Radio receiving sets	350	− 34
Other telephone instruments and parts	701	+ 210
Dynamos and motors, not over 100 kg.	865	− 179
Dynamos and motors, not over 5,000 kg.	91	− 118
Dynamos and motors, other	713	− 291
Dynamo sets	102	+ 96
Transformers	136	+ 61
Carbon for electrical use	1,357	+ 81

Parliamentary News (BY OUR SPECIAL REPORTER)

Powers of the Commissioners

Mr. Garro Jones asked the Minister of Transport on April 28th whether he was aware that the Electricity Commissioners had called upon electricity supply companies to submit to them their proposals to make issues of capital, and had assumed power to assent or withhold their approval thereto; and if he would state under what statutory authority the Commissioners were acting in such cases.

Mr. Hore-Belisha said he was not aware that the Commissioners had assumed any powers not given to them by statute. They had power, in certain cases, to make a Special Order conferring additional capital powers on an electricity supply company. Upon any application for such a Special Order, the Commissioners were entitled to exercise their discretion in deciding whether to make or to refuse to make the Order. Any Order made was subject to confirmation by him and approval by Parliament. A company might alternatively apply direct to Parliament for additional capital powers.

Electricity in S.E. England

On April 28th the Kent Electric Power Bill was submitted to the House of Lords Committee on Unopposed Bills. Lord Onslow presided. It is recited in the preamble that the Electricity Commissioners consider that a new generating station is necessary in connection with the South-East England Electricity Scheme, 1927, and that the erection of the first part of the station is urgent. They have approved of the Kent Co. providing the station. In these circumstances the Bill has been presented as a "late" Bill after the ordinary time to enable the company to erect the station on a site forming part of Littlebrook Farm, in the parish of Stone, near Dartford. To finance the scheme it is proposed to borrow £2,500,000 on mortgage or by the issue of debentures and there is a clause in the Bill providing that any further sum required may, with the consent of the Electricity Commissioners, be provided in the same way. It is also proposed to increase the share capital to £2,000,000 in order to finance the company's growing business and to convert the present priority shares into 6 per cent. preference shares. There being no petitions against the Bill only formal evidence was given and it was ordered to be reported for third reading.

North Metropolitan Electric Power Bill

The same Committee also considered the North Metropolitan Electric Power Bill which provides for the transfer to the North Metropolitan Electric Power Supply Co. of the Harrow Electric Light and Power Co.'s undertaking. It was contested in committee in the House of Commons but the opposition was not carried to the House of Lords. After formal evidence in proof of the preamble the Bill was ordered to be reported for third reading.

Railway Electrification

On April 29th Mr. Lyons asked the Minister of Transport if he could state the mileage of British railways electrified during 1936.

Mr. Hore-Belisha said that during 1936 forty-four additional route miles of railway were inspected and passed by his officers for electrical working, though they were not opened for traffic until January of this year.

The Speaking Clock

On May 3rd Mr. Day asked the Postmaster-General whether he could state the country of origin and the cost of installation of the speaking clock which was used in the London Telephone District, and when it was proposed to introduce similar extended services.

Major Tryon said that the speaking clock was designed by the Post Office Engineering Research Department and was constructed by Post Office engineers from parts manufactured in this country. The total capital cost of the installation of the mechanism and associated plant, including the necessary preliminary experiments, was about £9,000. In addition, substantial expenditure was incurred in day-to-day maintenance and in the provision of power and of exchange and junction plant and of operating staff for dealing with the calls. The extension of the service to other large centres was dependent upon the manufacture of special equipment and the provision of additional line plant.

In the Courts

Supply for the Wirral Electrification

Mr. Justice Simonds in the Chancery Division on April 29th delivered his considered judgment in the case of the Attorney-General (at the relation of the Birkenhead Corporation) against the Liverpool Corporation and the L.M. & S. Railway Company on the motion (which the parties had agreed to treat as the trial of the action) by which the plaintiffs sought an order restraining the Liverpool Corporation from supplying to the railway company electricity for use in connection with its Wirral lines and a similar order restraining the company from taking that supply.

Subject to the result of the present action the company had decided to take its supply of electricity from the Liverpool Corporation, which had to supply it at a point within the Liverpool area. The plaintiffs alleged that such a supply would be *ultra vires* the Corporation's statutory powers under the Wirral Act, 1900. The defendants, on the other hand, contended that the provisions of that Act did not operate to exclude the alleged enabling power conferred under Section 47 of the Electricity Supply Act, 1926.

His Lordship, in the course of reading a long written judgment and having stated the agreed facts, said he was of the opinion that both the defendant railway company and the Liverpool Corporation had brought themselves within Section 47 of the Electricity Supply Act, 1926, and that the Minister of Transport was competent to give his consent to the Liverpool Corporation supplying electricity to the company for any purposes of the railway undertaking whether within or without the area of supply of the Corporation.

Section 47 of the Act of 1926 was as follows:—

"Where any authorised undertakers may supply, and are supplying, within their district or area of supply electricity for haulage or traction to any company or authority being the owners or lessees of a railway, dock, harbour or canal undertaking, situate partly within and partly without that district or area, such authorised undertakers may, subject to the consent of the Minister of Transport, and to such limitations and conditions (if any) as he may prescribe, either generally or in any particular case, so supply electricity to be used for any purposes of such undertaking, whether within or without such district or area of supply, and such company or authority may, subject to the consent of the Minister of Transport and to such limitations and conditions (if any) as he may prescribe, either generally or in any particular case, use the electricity supplied for any purposes of their undertaking for which they are entitled to use electricity."

The Minister of Transport after due inquiry had given his consent to the proposed supply and user and that put an end to the matter. The motion must be refused and the action dismissed with costs.

[*Elec. Rev.* photos.

Some of the three hundred and fifty merrymakers at the Coronation Ball held by the Electrical Association for Women last Friday at the Park Lane Hotel, London. The right-hand picture shows Mrs. Barriedale-Johnson, Mr. D. Moffat, the Dowager Lady Swaythling and Miss Caroline Haslett

Business and Industrial Notes

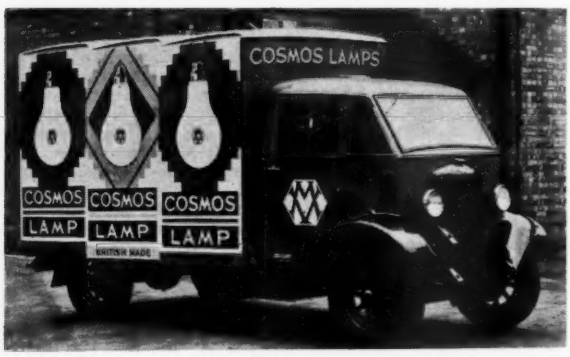
The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The F.B.I. Business Forecast

The "Business Forecast" published in the F.B.I. "Business Barometer" for the second quarter of 1937 states that unsettlement in certain directions in the next few months would not occasion surprise. However, there is no indication of a change in the basic trend. The full effects of the rearmament programme have yet to be felt, and many industries are booked up with orders for many months ahead. The prospects for the export trades continue to be good, and building activity, apart from private housing, is being well maintained.

A Met.-Vick. Delivery Van

The accompanying photograph shows a novel and striking design of delivery van which has been put into service by the London Office Lamp Sales Department of the Metropolitan-Vickers Electrical Co., Ltd. The body is a large-scale



A new delivery van put into service by the Metropolitan-Vickers Electrical Co.

replica of six "Cosmos" lamp cartons in colour—red, black and yellow. The van roof also carries an advertisement, which increases the publicity value of the van considerably as it conveys its message to people on bus tops, in high windows and, perhaps, in aeroplanes.

Brush Sales Conference

The annual sales conference of the Brush Electrical Engineering Co., Ltd., was held at Loughborough from April 28th to 30th, and was attended by directors, executives, and branch managers and technical sales engineers from various areas covering Great Britain. The accompanying illustration shows the directors and delegates who attended. The conference was presided over by Mr. H. E. Midgley, M.A. (Cantab.), M.Inst.C.E., a director of the company.

Contractors and the Coronation

It is reported that all E.C.A. federated employers have been recommended by their association to give their operatives a day's pay as a bonus for Coronation Day which is, of course, a Bank Holiday. If men work on this day they are entitled to time-and-a-half but it is suggested that this should not preclude the payment of the "bonus" at the ordinary rate.

E.L.M.A. Activities

The first street lighting conference, including special reference to electric-discharge lamps, to be promoted by the E.L.M.A. Lighting Service Bureau will be opened on May 21st at 2, Savoy Hill, W.C.2. The suggestion for the conference came from an informal meeting of the Incorporated Municipal Electrical Association, at which the opinion was expressed that with the rapid development of street lighting and the interest being taken by the Ministry of Transport, such a conference would be of great use. The first section will be introduced by Sir Charles Bressey, C.B., engineer to the Ministry of Transport, Highways Development Department (Greater London). Three research engineers who have specialised in street lighting will talk upon the various aspects of the problems, and discussions will be opened by Mr. J. W. J. Townley (engineer and manager, West Ham), Mr. W. N. C. Clinch (engineer and manager, Brighton), Mr. E. C. Lennox (president, Association of Public Lighting Engineers), and Mr. J. N. Waite (chairman, E.D.A. Street Lighting Committee).

A two-day course devoted to electric lighting in works and offices will be held by the Lighting Service Bureau at 2, Savoy Hill, W.C.2, on May 25th and 26th. Mr. J. W. Beauchamp, commercial manager of the Central Electricity Board, will open the course on May 25th, and the lectures which follow will deal with many aspects of the subject of correct illumination.

The first English provincial branch office to be established by the Bureau was opened on May 1st at 10, Apsom Chambers, 68, Albion Street, Leeds, 1. This new office is responsible for an extensive area including Leeds, Sheffield, Bradford, Halifax, Huddersfield, Hull, York, and the area of the Yorkshire Electric Power Co., and will meet a long-felt need in an area where there is wide scope for improving the standard of electric lighting. As we announce in our Personal Column, Mr. J. W. Howell has been appointed to take charge of the office. This provincial activity will consist of promoting the cause of better lighting in co-operation with the supply interests in the area, encouraging their active promotion of lighting service by personal contact in a more direct manner than was possible working from London. In addition, it is hoped to gain the co-operation of electrical contractors, retailers, wholesalers and ironmongers in organising lectures and talks for the benefit of electrical trade groups and associations, industrial groups, and sales staffs.

The "Golden Guide"

The 1937 edition of "Sell's Classified Trades List" (The "Golden Guide") is now available (Business Dictionaries, Ltd., 8 & 9, Johnson's Court, E.C.4, 10s. 6d.). This list, which contains the particulars of about 130,000 firms, will be of considerable value for finding suppliers of every kind of commodity, particulars of packing and transport and financial service, for issuing tenders and seeking quotations, or for circularising for business. Reference to the classified trades section is facilitated by an alphabetical index.

Orders Recently Booked

A 3½-ton electric furnace has recently been built by Edgar Allen & Co., Ltd., for the Electric Furnace Co., Ltd. This furnace is for overseas and will be installed for the making of steel castings as well as ingots. It incorporates balanced electrode gear, remote operated tightening gear for the electrode holders, and special cast-steel stiffeners around the top of the furnace shell and over the door openings. Provision is made for radial and horizontal adjustment of the electrode arms. The electrical gear consists of a 1,200-kVA transformer having variable high reactance for arc furnace work, with tappings on the low-voltage side, selected by means of a motor-operated tap change switch. The high-voltage switch controlling the transformer is of standard type, complete with the necessary push-buttons for operating the tap change switch. High-speed automatic electrode regulators are also provided. The furnace is designed for melting a normal charge of 3½ tons in approximately 2½ hours. To this, of course, must be added the time for refining, &c.

Directors and delegates at the annual sales conference of the Brush Electrical Engineering Co. held last week

Following the successful "Sieray" street-lighting installation in Euston Road the St. Pancras Metropolitan Borough Council has placed a further order with Siemens Electric Lamps & Supplies, Ltd., for 110 similar units to complete the re-lighting of this thoroughfare and to effect further street-lighting improvements in the borough.

New Electricity Showrooms

The new electricity showrooms of the Worthing Corporation Electricity Department are to be opened on May 10th by Earl Winterton, M.P.

The Croydon Corporation Electricity Department is contemplating the provision of enlarged offices and showrooms in the centre of the town. Among the sites which have been considered is one in Wellesley Road belonging to the Council. At Monday's meeting of the Council it was intimated that should the Department decide on the site the Council would probably allocate its use for that purpose.

The new electricity showrooms and offices of the Cleethorpes Corporation Electricity Department will be opened on Monday next by the Mayor, Ald. E. Houghton.

On the same day the North Lincolnshire and Howdenshire Electricity Co., Ltd., is to open its new "Electricity House" at Scunthorpe.

Social Events

On April 18th the Dramatic Section of the Benjamin Social and Athletic Club gave its first variety entertainment in the dance hall at the works. The programme included songs, dancing and sketches, which were well received. The accompanying picture shows the members who took part.

The annual sports meeting of A. Reyrolle & Co., Ltd., is to be held on June 12th at the company's sports ground. In addition to the usual events for employés there are to be four open events, including the three-mile championship of Northumberland and Durham.

Next Year's B.I.F.

More than half the total exhibiting space of the Engineering and Hardware Section of the British Industries Fair at Castle Bromwich, Birmingham, has been definitely let for the next Fair in February, 1938. At a meeting of the Fair Management Committee on May 3rd Mr. A. H. Godfrey, joint managing director of John Rabone & Sons, Ltd., was appointed chairman in succession to Mr. J. P. Plant, who has presided over the Committee for the past three years. The area let is, so far, 25,000 sq. ft. in excess of the comparable figures of a year ago. Referring to the Fair Management Committee's plans for 1938, Mr. Godfrey said that they were not contemplating any further major extensions of the Castle Bromwich buildings, but were to concentrate on improving the amenities in various directions. The necessary sub-committees had been appointed and work would begin at once.

Ceylon Customs Tariff

The *Board of Trade Journal* contains a list of goods affected by the Customs Tariff now in force in Ceylon, from which we have extracted the following electrical items:—

	Preferential duty.	General duty.
Batteries and accumulators and parts thereof :—		
Dry cell ... ... per gross	—	3 Rs.
Wireless ... ... *ad valorem*	15%	25%
Other (except splash-proof for motor vehicles)... *ad valorem*	10%	20%
Electrical apparatus certified as having been imported for use in the campaign against anchylostomiasis, for educational purposes or for research work	—	Free
Electrical goods, apparatus and instruments and parts thereof not elsewhere specified ... ... *ad valorem*	15%	25%
Electric bulbs ... ... *ad valorem*	15%	25%
Electric lighting accessories and fittings not elsewhere specified including small switches under 10 A. carrying capacity *ad valorem*	15%	25%
Electric wires and cables (insulated) ... ... *ad valorem*	15%	25%
Telegraph and telephone instruments and parts thereof (except wireless) ... ... *ad valorem*	15%	25%
Wireless goods and apparatus and parts thereof .. *ad valorem*	15%	25%
Electrical machinery and component parts thereof :—		
Control and switchgear, not including small switches under 10 A. carrying capacity ... ... *ad valorem*	10%	20%
Electrical machinery not elsewhere specified ... *ad valorem*	15%	25%
Generators, alternators, dynamos and exciters... *ad valorem*	10%	20%
Magnetos not elsewhere specified ... ... *ad valorem*	15%	25%
Motors ... ... *ad valorem*	10%	20%
Transformers and convertors ... ... *ad valorem*	10%	20%

Coronation Holiday Arrangements

Our Advertisement Dept. ask us to say that classified advertisements for our issue of May 14th should reach them by 5.30 p.m. Monday, May 10th.

Consequent upon the proximity of the Coronation celebrations and Whitsun the Dubilier Condenser Co. (1925), Ltd., is closing its factory at Victoria Road, North Acton, W.3, from May 11th to May 18th. In view of the exceptional nature of the occasion and the desire of the directors to afford every facility for participation in the festivities, employés will be paid for the Coronation period. Special planning of production has been arranged so that customers need have no apprehension as regards delivery.

A Coronation day bonus for all their employés is announced by Blackstone & Co., Ltd. The bonus will in each case equal the time rate for the normal number of working hours.

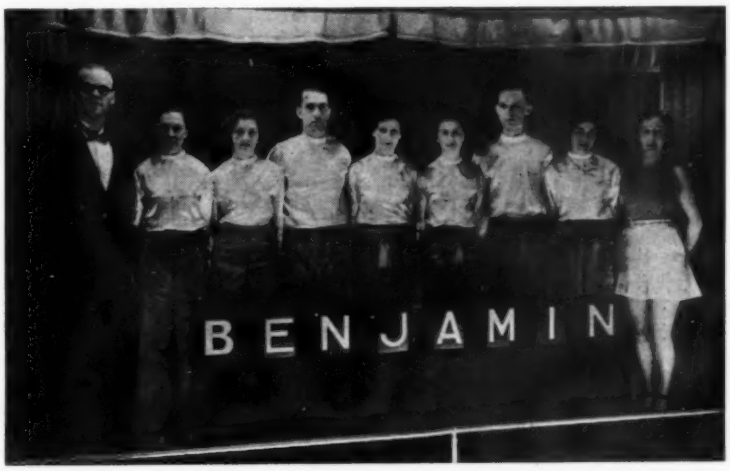
The directors of British Insulated Cables, Ltd., are giving a day's holiday with pay to their employés on Coronation Day.

Radio Patents in Germany

The old agreement between the Telefunken Co. and a group of twenty-five radio works in regard to the licences granted to the latter has lapsed and been replaced by a new one further regulating the patent rights of both parties. The royalties payable on the licences have again been reduced by 15 per cent. Although this reduction will have no direct influence on the sale prices of radio products, it is expected that it will stimulate the productive possibilities of the German radio industry and in the long run lead to lower prices.

Industrial Opportunities in Bombay

The Rotary Club of Bombay has issued a handsomely produced and illustrated book entitled "Bombay, the Gateway of India," which has been published with the object of bringing before the world the advantages which the City of Bombay offers to industrialists and business men. Chapters are included on the industrial possibilities of the City; building the factory, site cost, construction cost and land tenure details; and particulars of the electricity supply services. The illustrations include examples of the Bombay Electric Supply and Tramways Co.'s sub-stations.



Members of the Social and Athletic Club of the Benjamin Electric, Ltd., who recently gave their third performance

Trade Commissioner's Office at Brisbane

With reference to the announcement in the *Board of Trade Journal* regarding the appointment of Mr. J. R. Adams to the new post of H.M. Trade Commissioner to be established at Brisbane, the Department of Overseas Trade announces that Mr. Adams has now secured office premises which will be opened on or about May 15th. Communications should be addressed as follows: H.M. Trade Commissioner, Estates Chambers, Creek Street, Brisbane. The post of Imperial Trade Correspondent at Brisbane is being abolished.

A Rotary Switch Catalogue

A new catalogue dealing with rotary switches and embodying many original features has been brought out by "Diamond H" Switches, Ltd. The index segregates surface switches from flush switches and a thumb index is provided. Blue print diagrams with dimensions are given on each page; a full section is devoted to 500-600-V switches; a section for flush cooker switches gives details of fixing arrangements available; comprehensive details for cast-iron boxes are included and full details of the latest type of hydraulic thermostatic apparatus are given.

Radio Servicing

The Board of Education, with the co-operation of the Radio Manufacturers' Association, is arranging a short course in radio servicing for teachers in technical schools. The course will be held from July 19th to 24th, partly at the Polytechnic, Regent Street, London, W.1, and partly in the servicing departments of radio manufacturing firms. It will be conducted by Dr. F. T. Chapman, H.M. Inspector of Technical Schools, with the assistance of lecturers from the co-operating firms and the B.B.C. Application must be made not later than May 21st on form 106U (T.xviii) obtainable from the Board of Education, Whitehall, London, S.W.1. Accommodation will be available (bed and breakfast 5s. 6d. per day), and claims for travelling expenses should be made on form 112U.

Jersey Trades Exhibition

The Jersey Electricity Co., which has recently introduced a two-part tariff, took the fullest advantage of the opportunity offered by the Jersey Trades Exhibition to increase the popularity of electricity on the Island. An attractive stand, incorporating many novel features, included a large illuminated map, which showed clearly those portions of the Island where an electricity supply is already available and where immediate extensions are contemplated. The Diesel plant which supplies

power to the Island was portrayed by three models, and the back of the stand was finished off by two illuminated recesses which housed various domestic appliances, such as irons, kettles and other small electrical devices. An instructive demonstration giving details of the two-part tariff and price reductions over a period of years was arranged on the front of the stand. Architectural lamps were extensively used, noticeably in compiling an illuminated graph showing the continuous fall in the price of electricity during the past few years. Assistance was given to the Jersey Electricity Co. by the General Electric Co., Ltd., and L. G. Hawkins, Ltd. Mr. F. M. Burrell is the chief engineer and manager of the undertaking.

Zinc and Corrosion

As much as 20 per cent. of the world's output of iron and steel is said to be lost each year due to corrosion. Zinc, which has a much lower corrosion rate (the extent depending upon its purity) forms an inexpensive protection and its use for this purpose has during the past fifteen years considerably increased in this country by the development of the Schorfe process. In this method molten zinc (in which impurities have been reduced to less than 0.01 per cent.) can be sprayed from a "pistol" by a stream of compressed air or other gas to form an adherent film of upwards of 0.002 in. on the article treated. The particles on impingement are so reduced in temperature that they do not damage the surface. The corrosion product of zinc, unlike that of iron, prevents further corrosion, and as zinc is higher in the electro-potential series it also affords "sacrificial" protection, *i.e.*, the zinc alone tends to be attacked, even when there are gaps in the coating. Among the illustrations in a brochure issued by the Imperial Smelting Corporation, Ltd., entitled "Corrosion Protection," is one of an outdoor transforming station, the metalwork of which has been zinc-sprayed, as have many towers for transmission lines. Cases in which the Schorfe process has been applied for purposes other than the prevention of corrosion are also exemplified in electric shielding, in which the requisite is the provision of a continuous conducting film and in the semi-automatic metallising of the glass of radio valves.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price. May 5th.	Fortnight's Inc. or Dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal) ... „	£18 10s.	—
a Borax ... ... „	£17	—
a Copper, Sulphate ... ... „	£15 10s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a „ Perchlorate ... ... „	6d.	—
a Shellac... ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a „ Roll ... ... „	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a „ Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b „ Wire ... ... per lb.	1/1 to 1/9	—
b „ Sheet and Foil... ... „	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£230	£14 dec.
Grade II ... ... „	£160	£10 dec.
Grade III ... ... „	£87	£5 dec.
c Brass (rolled metal 2" to 12" basis) ... per lb.	9½d.	¼d. inc.
c „ Tubes (solid drawn) ... ... „	1/0½ to 1/1	¼d. inc.
c „ Wire, basis ... ... „	10½d.	¼d. inc.
c Copper Tubes (solid drawn) ... ... „	1/2½	—
g „ Bars (best selected) ... ... per ton	£93	£3 dec.
g „ Sheet ... ... „		
g „ Rod ... ... „		
d „ (Electrolytic) Bars ... ... „	£65 10s.	£1 10s. dec.
d „ „ Wire Rods ... „	£70 10s.	£1 10s. dec.
d „ „ H.C. Wire ... per lb.	10 1/16d.	1/16d. dec.
f Ebonite Rod ½" dia. & up ... ... „	1/10 to 2/9	—
f „ Sheet ⅛" thick & up ... ... „	1/7 to 1/10	—
n German Silver Wire, Nos. 1 to 12 ... „	2/5	1d. dec.
h Gutta-percha, fine ... ... „	nom.	—
h India-rubber, Para-fine ... ... „	11½d.	½d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s. 0d.	—
i „ Wire galv. No. 1, P.O. Qual.... „	£20	—
g Lead, English Pig ... ... „	£26 10s.	£1 10s. inc.
g Mercury ... ... per bot.	£13 17s.	10s. 6d. dec.
e Mica (in original cases) small ... per lb.	10d. to 2/-	—
e „ „ „ medium ... „	6/- to 12/6	—
e „ „ „ large ... „	13/- to 17/6 up	—
p Phosphor Bronze, plain castings ... „	1/3½	—
p „ „ drawn bars & rods „	1/3½	½d. dec.
p „ „ rolled strip & sheet „	1/1	1d. dec.
p „ „ wire ... ... „	1/3	¾d. dec.
o Platinum ... ... per oz.	£11 5s.	10s. dec.
d Silicium Bronze Wire ... ... per lb.	10 1/16d.	1/16d. dec.
g Spelter ... ... per ton	£23 17s. 6d.	£1 10s. inc.
r Steel, Magnet, in bars ... ... per lb.	7½d.	—
g Tin, Block (English) ... ... per ton	£252 10s.	£3 inc.
n „ Wire, Nos. 1 to 16 ... ... per lb.	4/6	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes."

A Trolley-bus Maintenance School

A school on the subject of trolley-bus equipment was recently held at the Trafford Park and Sheffield Works of the Metropolitan-Vickers Electrical Co., Ltd. Eighteen transport authorities accepted the company's invitation, and thirty-seven delegates, mostly rolling stock engineers and maintenance shop superintendents, attended. On arrival at the works, the visitors were welcomed by Mr. G. E. Bailey, director and general manager of works, Mr. J. S. Peck, director of engineering, and Mr. H. C. Pierson, sales director. Mr. Bailey, in a short speech, remarked that this was the first occasion on which a direct attempt of this kind had been made to bring together the ideas and experience of manufacturers and users, and expressed the hope that the discussions would be frank and valuable both to those taking part and in general to the progress of the industry. Two of the days were spent at Trafford Park Works dealing with the subject of control equipment and one day at the company's works at Sheffield on the manufacture and maintenance of the motors, motor-generator sets and radio suppression coils.

Trade Announcements

The Provincial Wholesale Co., Ltd., Trent Warehouse, Wetmore Road, Burton-on-Trent, have been appointed agents to the Enfield Cable Works, Ltd., as from May 1st, for parts of Staffordshire, Derbyshire, Nottinghamshire and Leicestershire. They will work in collaboration with Mr. W. A. Lewis, branch manager of the Enfield Cable Works, Ltd., at Birmingham, and the principal activities of the agents will be in the sale of rubber insulated wires, cables and flexible cords, and "Enfield" wiring systems. The new agents were formerly the agents of the India Rubber, Gutta Percha and Telegraph Works Co., Ltd.

The Radio Wholesalers' Federation

The ninth annual general meeting of the Radio Wholesalers' Federation was held at the Connaught Rooms, Great Queen Street, London, on April 28th, when there was a large attendance. Mr. C. H. G. Hobday, the president, occupied the chair and in proposing the adoption of the annual report revealed a vast amount of work done by the Council during the year for the benefit of the members and, in some respects, for the radio wholesale trade generally. The annual accounts submitted by the honorary treasurer, Mr. A. J. Dew, showed a satisfactory balance despite a large expenditure on advertising and propaganda. At a Council meeting following the annual general meeting the officers for 1937-38 were unanimously elected as follows: President, Mr. C. H. G. Hobday (Hobday Brothers, Ltd.); vice-president, Mr. E. Smith (Midland Auto Components); hon. treasurer, Mr. A. J. Dew (A. J. Dew & Co., Ltd.).

Gas Prices

Last week the Parliamentary Committee on Gas Prices published its recommendations. The Committee was appointed in September last as a result of the public outcry against a form of sliding-scale tariff instituted by the South Metropolitan Gas Co. and then suspended. The new tariff replaced the flat-rate method of charge and was stated to operate unfairly in the case of the small consumer. At present gas companies operate under a "basic charge" system which relates dividends to prices and the Committee considers that this method, with suitable safeguards to the companies, should be continued. The safeguards are a minimum quarterly charge to ensure that service costs are recovered; and a special charge to people who have gas merely as a stand-by. Price increases amounting to more than 12½ per cent. should be imposed only with the sanction of the Board of Trade after one month's notice to the Board and the public.

In the course of the report the Committee refers to the competition to which gas is now subjected and says: "The houses and streets in which electric light does not compete with gas are rapidly decreasing, and even when a large district (as, for example, twenty per cent. of Newcastle) has no electric light, the price of gas in that district of partial monopoly for lighting is controlled by the competition of electricity in other parts of the same town, because the same prices must be charged for gas over both areas. The suggestion that electricity does not compete for the custom of poor working-class districts seems remote from the facts. To give one example—in West Ham, the number of electric cookers rose from 145 to 8,365 in nine years."

Price Increase

The Westinghouse Brake & Signal Co., Ltd., announces that the prices of certain of its metal rectifier sets have been increased by 5 per cent.

New Catalogues and Lists

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—A comprehensive catalogue of electric clocks.

Babcock & Wilcox, Ltd., Farringdon Street, London, E.C.4.—An illustrated catalogue of railway wagon discharging appliances.

Trix Electrical Co., Ltd., 8-9, Clerkenwell Road, London, E.C.1.—Leaflets dealing with sound equipment, portable amplifiers, &c.

Chloride Electrical Storage Co., Ltd., Exide Work, Clifton Junction, near Manchester.—Details of "Chloride" batteries for air-raid shelters.

British Insulated Cables, Ltd., Prescot.—Details of "Macintosh" patent trailing cable.

Pope's Electric Lamp Co., Ltd., 5, Arthur Street, London, W.C.2.—A list of "Elasta" automobile bulbs.

Simplex Electric Co., Ltd., 159, Great Charles Street, Birmingham, 3.—A price list of conduit.

Bankruptcy Proceedings

W. Dickinson, trading as W. Dickinson & Co., Highcot, Albion Road, Bexleyheath, Kent, lately carrying on business at Graham Road, Bexleyheath, engineer.—At the public examination herein held at the Court House, Eastgate, Rochester, recently, it was disclosed that there were liabilities of £2,973 and assets of £502, leaving a deficiency of £2,471. Debtor said he commenced trading in 1904 with a capital of £100 as an electrical wiring contractor at The Broadway, Bexleyheath. Later he manufactured electric motors. In 1912 he sold the manufacturing side of the business to a limited company, of which he was appointed a director. The business at The Broadway, Bexleyheath, was continued under the supervision of a manager. In 1930 the limited company ceased trading. The trade debts were discharged, but debtor was still personally liable for the bank overdraft. He continued his own business, taking over the works of the limited company. In 1934 he took over a plating business which had involved him in a loss of about £1,000. Since 1935 his financial position had become worse, and on March 18th last he closed his business. He said he had been aware of his position since July, 1936. The examination was closed.

M. Brown, wireless and radio dealer, Church Crescent, Muswell Hill.—A sitting of the London Bankruptcy Court was held on April 28th before Mr. Registrar Kean for the further public examination of this debtor. The accounts which were presented showed liabilities of £480 and no assets. At the previous sitting the debtor was ordered to file a cash account for explanation of his deficiency. He was now questioned by Mr. L. A. West upon the disposal of the assets, and the answers being regarded by the court as unsatisfactory the examinaiton was adjourned *sine die*.

H. K. Hawkins, electrical engineer, lately of Beaufort Road, Edgbaston, Birmingham.—The statutory first meeting of creditors under this failure was held on April 27th at London Bankruptcy Buildings. Mr. S. W. Hood, Official Receiver, reported that the receiving order was made on April 13th upon the petition of creditors. The debtor had not surrendered, nor was any information available regarding his affairs or present movements. The case was left with the Official Receiver to be wound up in bankruptcy.

A. F. Gunstone (deceased), 26, The Market Place, Westbury, Wilts, wireless dealer.—An administration order was made against this estate recently and according to the statement of affairs which has been filed in the proceedings the gross liabilities amount to £337, of which £229 is expected to rank for dividend, against net assets of £9, leaving a deficiency of £220. The failure is ascribed to lack of capital and ill-health.

W. R. Mew, wireless and electrical engineer, "Silvermere," Lushington Hill, Wootton, I. of W.—Receiving order made April 26th on debtor's own petition.

H. G. Hayward (Modern Electrical Service), electrical engineer and radio dealer, 42, Wilton Avenue, Southampton, lately carrying on business at Cambridge Road, Southampton.—Receiving order made April 26th on debtor's own petition. First meeting May 11th at 10, Rockstone Place, Southampton. Public examination May 19th at the Court House, Southampton.

J. English, radio and electrical engineer and contractor, 287, Alcester Road South, King's Heath, Birmingham.—First meeting May 13th at 159, Great Charles Street, Birmingham. Public examination June 16th at the Court House, Birmingham.

H. Cooke (Western Wireless), wireless and electrical engineer, 33, Fisherton Street, Salisbury.—Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver, released April 22nd.

A. W. Cowgill, radio and electrical engineer, 26, Water Street, and 49b, Vale Road, Rhyl.—First and final dividend of 2s. 0½d. in the £, payable May 14th at 3, Clwyd Street, Rhyl.

H. A. Simpson and **E. Dyson** (Simpsons), radio and electrical engineers, 18, Eastbank Street, Southport.—First dividend of 2s. 6d. in the £, payable April 30th at 413, Lord Street, Southport.

A. Hitner, electrical engineer and radio dealer, 7, Linden Grove, Fallowfield, Manchester.—First meeting May 11th at 20, Byrom Street, Manchester. Public examination June 11th at the Court House, Quay Street, Manchester.

Private Arrangements

Charlton Higgs (Radio), Ltd., wireless manufacturers, Westbourne Place, Hove, Brighton.—In response to a circular letter issued by Spain Bros., Dalling & Co., C.A., 1, Pavilion Buildings, Brighton, a meeting of the creditors of the above was held on April 30th at the Institute of Chartered Accountants, Moorgate Place, London, E.C. An approximate statement of affairs was submitted which showed ranking liabilities of £5,229. The net assets were £707, leaving a deficiency, as regarded the creditors, of £4,521. The issued capital of the company was £500, and so far as the shareholders were concerned there was a deficiency of £5,021. The present position was attributed to failure in the past to obtain supplies when they were urgently needed and lack of capital. On May 1st, 1936, there was a debit balance on the profit and loss account of £1,463, and it was estimated that since that date there had been a trading loss of £1,635. An offer was submitted of a composition of 5s. in the £, and it was stated that the directors considered that there was a future for the business. A resolution was passed agreeing to accept the offer of 5s. in the £.

J. R. Fenwick, electrical engineer, 26, Nile Street, North Shields.—At a meeting of the creditors of the above the statement of affairs showed ranking liabilities of £185, with assets of £60, leaving a deficiency of £125. It was decided that the matter should be dealt with under a letter of authority to Mr. P. Dodds to empower him to realise the assets and distribute the proceeds *pro rata* amongst the creditors in settlement of their claims. It was further agreed that the claim of the debtor's wife should be withdrawn.

Electricity Supply

Lighting, Domestic, Power

Accrington.—LOAN.—Application is to be made to the Electricity Commissioners for permission to borrow £6,000 for the purchase of sub-station transformers, switchgear and equipment during the ensuing three years.

Argentina.—ELECTRIC POWER SUPPLY PROGRESS.—The report of the Compania Hispano-Americano de Electricidad, which, under the name "Chade" operates electric generating stations for the supply of power in the city and province of Buenos Aires, states that the output during 1936 was 1,178 million kWh, as compared with 1,096 million kWh in the preceding year, an advance of just over 7 per cent. During the year the number of consumers increased from 589,124 to 613,603. An additional agreement was concluded in December last with the Municipality of Buenos Aires, extending the duration of the concession to 1972. The output of the Société d'Electricité de Rosario increased from 111 million kWh in 1935 to 115 million kWh last year, and the number of consumers from 64,120 to 67,552. In order to meet the growing demand a new 33,000-kW turbo-generator set is being installed at the power station.

Barking.—STREET LIGHTING.—Sanction to borrow £1,082 for altering the street lighting in River Road has been obtained by the Electricity Committee.

Barrhead.—HOUSE INSTALLATION.—The question of providing electrical installations in all of its houses not already wired is being considered by the Town Council.

Berwick (Northumberland).—CHANGE-OVER.—The Scottish Southern Electric Supply Co., Ltd., proposes to change the system of supply from d.c. to a.c.

Blidworth (Mansfield).—ELECTRICITY TO REPLACE GAS.—The Parish Council has decided to abolish the gas lamps and substitute electric lamps. Electricity will be supplied by the Derby & Notts Electric Power Co.

Bradford.—NEW BOILERS.—The Electricity Committee has approved a scheme for the installation of two boilers (in place of the existing nine boilers) at the Valley Road power station at an estimated cost of £315,000.

Bristol.—EXTENSION.—Cables are to be laid across the River Avon to give an additional supply of electricity to the Ham Green Hospital. The estimated cost is £3,783.

Cheadle (Cheshire).—CHEAPER ELECTRICITY.—Reduction of the charge for lighting from 4½d. to 4d. per kWh as from the meter readings for the June quarter has been approved by the Electricity Committee.

Chirnside.—SUPPLY PROMISED.—The Scottish Southern Electric Supply Co., Ltd., states that a supply of electricity will be made available in the district within the next few months.

Denmark.—INCREASE IN CONSUMPTION.—Statistics covering the first three months of the current year show that electricity consumption in Denmark is increasing rapidly. Almost 206 million kWh was consumed, against 184 million kWh in the first quarter of 1936. The month of March alone, with an aggregate consumption of 64 million kWh, shows an increase of 9 million kWh.

Dudley.—SUB-STATION.—The Shropshire, Worcestershire & Staffordshire Electric Power Co. is to erect a sub-station on the Rosland estate.

Finchley.—SUB-STATIONS.—During the next two years a.c. equipment is to be installed in all existing sub-stations, and a number of additional kiosk sub-stations are to be established. It has been decided to seek sanction to borrow £15,000 for sub-station plant and equipment.

LOANS.—The Electricity Committee has obtained sanction to borrow £2,500 for services, and £7,500 for changing and altering consumers' apparatus.

France.—FORTY-HOUR WEEK.—By decree the application of the Forty-hour Week Act has now been extended to all electrical production and distribution works, except those attached to mines, which are to be separately treated. Any arrangement of hours is permissible, provided that no more than eight hours is worked in any day. In special cases the working hours per week may be forty-two on condition that no more than eight hours is worked in any twenty-four, and that each employé has at least one rest period of twenty-four hours per week. In the case of work necessary for the prevention of accidents, or for repairs following accidents, the limits per day do not apply.

HYDRO-ELECTRIC POWER SUPPLY PROGRESS.—The Société des Forces Motrices de la Truyère reports that the Truyère River provided abundant supplies during the first eight months of 1936, but very little during the last four months. The great capacity of the Sarrans reservoir, however, enabled the company to meet the demand for supplies of electrical energy during the dry months, although a number of its customers' demands were exceptionally high at that time. The total output of the company's stations last year was 681,200,000 kWh, as against 671,600,000 kWh in 1935. It has been decided to duplicate the Rueyres-Marèges section of the 220-kV line from Rueyres to Paris.

Germany.—BERLIN.—The report of the Berliner Kraft und Licht Gesellschaft (Bewag), which supplies electric power in

the Berlin area, shows that during the financial year ended June last the sales of power amounted to 1,591 million kWh, as compared with 1,482 million kWh in 1934-35, and that the number of consumers advanced during the twelve months from 1,230,050 to 1,271,467.

Glasgow.—NEW EQUIPMENT.—It is proposed to erect and equip an additional 20,000-V feeding point at Aikenhead Road and to install 20,000-V and 6,500-V switchgear and 20,000/6,500-V transformers in various sub-stations at an estimated cost of £31,200. Sanction to borrow this amount has been received from the Electricity Commissioners.

Ipswich.—SUB-STATION.—The Electricity Committee has purchased a sub-station site in Tuddenham Road in connection with the provision of a supply to the Red House Park estate.

Jarrow-on-Tyne.—STREET LIGHTING.—The Town Council proposes to spend £1,185 on improving the electric lighting of York Avenue.

OVERHEAD LINES.—Plans by the North-Eastern Electric Supply Co., Ltd., for the erection of overhead lines at Hedworth have been approved by the Town Council.

Lancashire.—COUNTY COUNCIL AND OVERHEAD LINES.—The Highways and Bridges Committee of the County Council has recommended that "an expression of profound dissatisfaction" shall be conveyed to the Minister of Transport at permission being granted to the Lancashire Electric Power Co. to place overhead lines at Samlesbury. A public inquiry was held in February. In reply to a recent communication from the County Council the Minister of Transport stated that he could not properly proceed upon the view advanced at the inquiry that he should consent to the placing of lines above ground only if he were satisfied that it was impracticable for a supply to be given by underground cable without loss to the company.

Lancaster.—LOANS.—Application is to be made by the Electricity Committee for sanction to borrow £8,850 in respect of plant and £12,800 for mains to give a supply to the White Cross Mills.

London.—SUBURBAN DEVELOPMENT.—At a meeting of the London and Home Counties Joint Electricity Authority last week it was reported that sums amounting to £206,555 are to be spent, subject to the Electricity Commissioners' sanction, on increasing the capacity of mains to Surbiton, Sutton and Twickenham.

ELECTRICAL INSTALLATIONS.—The London County Council is to install electricity in the residential quarters at five fire stations at a cost of £594.

TUNNEL VENTILATION.—Ventilation at Blackwall Tunnel is to be improved at a cost of £20,500. Additional electric fans are to be installed and existing fans replaced by larger and more modern types.

AMPLIFYING EQUIPMENT IN PARKS.—The London County Council is to provide amplifying equipment and electric lighting at park bandstands. At first four bandstands are to be so equipped, at a cost of £1,050.

BATTERSEA.—The Electricity Committee is to lay an additional low voltage feeder from the Grayshott Road sub-station to Clapham Common at a cost of £2,238. A sum of £1,868 is to be spent on cable replacement at Broomwood Road.

The lighting at Clapham Common is to be improved by the Electricity Committee at a cost of £503 and at Wandsworth Common at a cost of £601.

ST. MARYLEBONE.—The L.C.C. is to provide a new electrical installation at the Institution, at a cost of £2,860.

BERMONDSEY.—Sanction has been obtained to loans of £17,000 for mains and services, and £3,000 for meters.

STOKE NEWINGTON.—For sub-stations and equipment the Electricity Committee has obtained sanction to borrow £5,000.

HACKNEY.—The Finance Committee is to raise a loan of £25,000 for street-lighting improvements.

HAMMERSMITH.—The Electricity Committee has obtained sanction to borrow £11,212 for sub-stations.

Switchgear at Broadway Chambers sub-station is to be replaced at a cost of £6,041.

ST. PANCRAS.—The Electricity Committee recommends improvements in street lighting at a cost of £4,292.

Morecambe.—PROFITS "RAIDED."—When the Town Council met recently to fix the rate for the ensuing year Alderman J. Snowden, chairman of the Finance Committee, said that from the £14,885 profit on the electricity undertaking £4,000 went to the relief of the rates and the remainder to reserve. He was seriously alarmed at the way in which the undertaking's profits were being "raided," and regarded this policy as altogether wrong.

Nottingham.—LOAN FOR DEVELOPMENT.—As the capital sum of £250,000 sanctioned by the Council in December, 1935, has been nearly expended, the Electricity Committee proposes to make application to the Electricity Commissioners for permission to borrow a similar amount for general mains extensions, sub-stations, &c.

Northern Ireland.—LOAN GUARANTEE.—The principal and interest of a loan of £150,000 up to January 1st, 1938, have been guaranteed by the Northern Ireland Minister for Finance under the Electricity Supply Act, 1931. The loan is proposed to be raised by the Electricity Board for Northern Ireland under Section 2 of the Act for various statutory purposes of the Act. Sums aggregating £1,850,000 have already been guaranteed by the Ministry, making, with the sum now proposed to be advanced, a total of £2,000,000.

Plymouth.—NEW CABLES.—The Street Lighting Committee has decided to have new cables laid in six roads in the city and to strengthen the existing network in three neighbouring roads at a total estimated cost of £1,886.

Palestine.—LARGE NEW POWER STATION.—Construction of a new power station which is expected to cost about £500,000, is to begin in a few weeks on a site covering 25 acres at Tel Aviv, states a *Reuter* message from Jerusalem. The station will serve the northern part of Tel Aviv and its environs. This area is at present supplied with electricity from the Palestine Electric Corporation's power station in the Haifa Bay area, about 60 miles away. The machinery is being purchased in Great Britain. The scheme includes the building of a £15,000 bridge across the River Yarkon.

Russia.—SVIR HYDRO-ELECTRIC POWER STATION.—The construction of a new 160,000-kW hydro-electric power station has been commenced on the upper reaches of the Svir River, north of Leningrad. The lower Svir power station (120,000 kW) was put into operation seven months ago. When the new station is completed the level of the water in the upper reaches of the river will rise to the level of Lake Onega.

Spennymoor.—ELECTRIC STREET LIGHTING.—The decision to change the street lighting from gas to electricity has been reaffirmed by the Council, and sanction is being sought to a loan of £3,480 to defray the cost. A vain effort was made to secure further consideration of the matter following the receipt of a letter from the Gas Company. A councillor declared that the loss of the contract would mean the dismissal of a number of workmen at the gasworks, and he considered that if these men could be retained by placing the contract in the town the Council should see if that could be done.

Stoke-on-Trent.—NEW EQUIPMENT.—The North West Midlands Joint Electricity Authority has decided to meet the whole of the expenditure of £100,000 in connection with the provision of switch house, switchgear, &c.

CHANGE-OVER.—The Electricity Committee is to proceed with the change-over of supply in the London Road area to a.c. at a cost of £2,700.

LOANS.—Sanction to borrow £13,900 for mains and £6,165 for a sub-station has been obtained by the Electricity Committee.

SUPPLY EXTENSION.—The Electricity Committee is to afford a supply at a cost of £1,500 to 149 houses to be erected at Portbill.

United States.—ELECTRICITY OUTPUT.—The Federal Power Commission is stated in the *Electrical World* to have announced that 113,473,000,000 kWh of electricity was generated for public supplies in the United States during 1936. The increase over the previous year was 14,000,000,000 (14 per cent.), due mainly to a larger output (22 per cent. increase) from fuel, whereas from water power there was an increase of only 2 per cent. Preliminary statistics show the average fuel consumption in steam stations to be about 1.45 lb. per kWh as compared with 1.45 lb. in 1935.

Whitby.—SUPPLY SCHEME DEFERRED.—At last week's meeting of the Rural District Council it was reported that the North-Eastern Electric Supply Co. had deferred for the time being its application to the Minister of Transport for consent to the erection of an overhead line at Goathland owing to opposition from residents and the Council to the overhead system of distribution. Regret was expressed at this attitude, and it was contended that it was the company's duty to provide a supply to Goathland even if it meant laying underground cables. It was decided to approach the company.

Worcester.—REVISED CHARGES.—At its meeting on Tuesday the City Council approved a report of its electrical engineer (Mr. C. M. Shaw) recommending revisions of electricity charges. The long-hour lighting tariff (No. 2) is to be 8d. for the first hour's use of m.d. per quarter (91 hours) and 1d. per kWh for additional consumption, instead of 8d. and 2d. Under the rateable value tariff (No. 7) the kWh charge will be ½d. instead of ¾d. There is to be a corresponding reduction in the extended area. Consumers already having electric cookers are to be charged 1s. per quarter (instead of 2s. 6d.) for a 1½-gal. water heater, and 3s. 6d. (instead of 5s.) for a 12-gal. water heater, subject to a cash payment of 15s. to cover the cost of installation. Under the "all-in" tariff (No. 8) it is proposed that where a cooker is installed a water heater may also be supplied without additional charge per kWh, subject to the user guaranteeing to use another 4 kWh per week. To discourage frivolous applications, 15s. is to be charged for installation. The bulk-supply tariff is being extended as follows: 250,000 to 350,000 kWh per quarter, 0.39d. per kWh; 350,000 to 450,000 kWh, 0.38d. per kWh; and over 450,000 kWh, 0.37d. per kWh, a new coal clause being substituted. Where bulk-supply consumers whose normal annual load factor exceeds 20 per cent. are able to restrict their demands during the heavy-load hours of November to February a special rebate is to be made from the kW fixed charge.

York.—LOANS.—The Electricity Committee is seeking sanction to borrow £33,000 for mains and services, £10,000 for domestic apparatus for hire, and £1,064 for the provision of a supply of electricity to Heslington.

STREET LIGHTING.—Street lighting is to be provided from Bootham Bar to the city boundary at Clifton at an estimated cost of £1,623, and from Monk Bridge to the junction of Heworth Green and Stockton Lane, at a cost of £889.

Traction

Bristol.—BUSES TO REPLACE TRAMS.—The Corporation has recommended the promotion of a Bill to confirm an agreement between the Corporation and the Bristol Tramways and Carriage Co., Ltd., regarding the transfer to the Corporation of the company's tramway and light railway undertaking and the joint running by the Corporation and the company of public vehicles. The Tramways Option Committee has decided that oil or petrol omnibuses will best serve the requirements of the city.

Denmark.—COPENHAGEN.—According to a preliminary report from the Copenhagen passenger transport undertaking operations during the year which ended on April 1st have yielded a net surplus of almost 2¼ million kroner, or an increase of about 400,000 kr. as compared with the previous year. The improvement is due to certain reductions of the fares and to the new night tram and bus services, which have grown so popular that a number of new vehicles will be required to handle the traffic.

France.—PARIS UNDERGROUND EXTENSION.—A *Reuter* message from Paris states that an extension of the Paris underground railway was opened last week. It continues the line across Paris as far as the bridge over the Seine at Neuilly.

Glasgow.—PREPARING FOR THE EMPIRE EXHIBITION.—The principal underground stations at Copland Road and Cessnock are to be extended to cope with the increased traffic expected during the Empire Exhibition next year. The Copland Road station is to be altered at a cost of £1,700, after which the reconstruction of the Cessnock station will be undertaken.

Italy.—MILAN-COMO LINE ELECTRIFIED.—The first electric train has passed over the newly electrified line (a.c. at 3,000 V) from Milan to Como. A speed of 100 km. (62¼ miles) per hour can be attained on the level, and the time of the journey will be reduced from 60 to 45 minutes for fast and from 80 to 60 minutes for slow trains.—*Reuter's Trade Service.*

London.—STRIKE ACTION DISCUSSED.—At a meeting of tramway and trolley-bus men on Wednesday a resolution in favour of demanding plenary power from the General Executive Council of the Transport and General Workers Union for strike action in support of the bus drivers and conductors was debated. It was considered possible that should the Executive Council not accede this unofficial action would be taken.

Northumberland.—REQUEST FOR TROLLEY-BUSES.—The County Roads and Bridges Committee has had under consideration the condition of the tram track between Gosforth and Gosforth Park and has decided to ask the Newcastle City Council to consider scrapping the trams and starting a trolley-bus service.

South Shields.—TROLLEY-BUSES.—The Stanhope Road trolley-bus route came into operation on Monday last. The next route to be converted will be Ocean Road.

Spain.—ELECTRIC RAILWAYS.—A survey of railway electrification in Spain appears in the electric railway traction supplement of the *Railway Gazette*. Conversion has proceeded erratically, due to the multiplicity of interests controlling the railways in the country. The first electrification of a limited part of a main line was completed in 1909, when the Sur d' España company converted the Nacimiento-Gádor section of its Baeza-Almeria line, the length of route involved being 18.6 miles. The system adopted was 25-cycle, 5,500-V. In 1924 the Northern Railway electrified the 38.5-mile Busdongo-Ujo section of its main line from Madrid to Oviedo and Gijón. This has a gradient of 1 in 50 practically throughout, a constant succession of sharp curves through the Cantabrian mountains, seventy tunnels and 156 bridges. D.c. at 3,000 V is used. Encouraged by the results obtained on this section, the Northern Railway began to convert further main-line parts of its system, and its electrified sections now total 242 route-miles, or more than 10 per cent. of its system. Before the present trouble in Spain a start had been made on the electrification of a section of main line from Madrid to Avila, with an offshoot to Villalba and Segovia. Other lines which have been electrified include one of just over seven miles from Cercedilla, north of Escorial, to Puerto de Navacerrada, ascending the Guadarrama mountains, and another from Bilbao to Portugaleter, besides many narrow-gauge regional lines. Railways operated electrically since their inception include the underground lines at Madrid and Barcelona.

The Moscow "talking clock"

Sweden.—STOCKHOLM.—The passenger transport undertaking in Stockholm reports that passenger journeys on its tramways last year numbered 139¾ millions, against 135¼ millions in 1935. The total income amounted to 22,960,000 kr., which was an increase of 610,000 kr. The number of average tram journeys per inhabitant per annum rose from 258 to 262. The number of bus passengers rose from 38,990,000 to 43,810,000, and the total income under this heading advanced from 7,770,000 kr. to 8,750,000 kr.

Communications

Great Britain.—TELEVISION.—A rehearsal of the B.B.C.'s arrangements for televising the Coronation procession took place on Tuesday near Apsley Gate, Hyde Park Corner. The *Daily Telegraph* Radio Correspondent states that the pictures were as good as, if not better than, those from the studio, such details as the registration numbers of a car being discernible.

AUTOMATIC TELEPHONY.—Speaking at Liverpool on Saturday the Assistant Postmaster-General (Sir Walter Womersley) stated that it was proposed to erect an automatic telephone exchange building there which, with equipment, would cost about £600,000. The building would house an exchange of 9,500 lines and automanual switchboards for the whole area.

Greece.—MODERNISATION SCHEME.—According to the *Morning Post* a convention has just been signed between the Government and Cable & Wireless, Ltd., which, it is stated, will make it possible to carry out a big scheme of modernisation and improvement in the cable and wireless communications of the country. The convention replaces working arrangements which have been in existence for seventy years. Its result will be to link Greece more closely with the world-wide system of communications operated by Cable & Wireless, Ltd., and it will involve the erection of a new wireless station in Greece. The negotiations were carried out with the Greek Ministry of Communications by Admiral H. W. Grant, C.B., a director of Cable & Wireless, Ltd., who went to Greece at the request of Mr. Edward Wilshaw, chairman of the company.

Italy.—TELEPHONY AT HIGH ALTITUDES.—In a recent issue of *L'Elettrotecnica* Signor G. B. Senssaro gives particulars of the telephonic installation which has recently been completed for the Italian Alpine Club between Ortles and Cevedale to link up the different hotels and shelters in the district which are at heights ranging from 8,500 to 10,800 ft. above sea level. The plan adopted is that of a mixed system, comprising, first, a main double-conductor artery connecting the principal stations, the two extremities being connected to the main telephone system, and a radio-telephonic service working on 5-metres between the principal stations and the remotely situated shelters.

Russia.—TALKING CLOCK IN MOSCOW.—A "talking clock," designed by N. A. Nikitin, of the Moscow Research Institute of Communications, has recently been introduced in Moscow. This clock is connected to track lines of the city's telephone system. When a subscriber dials a certain number he is connected to the clock and hears a man's voice announcing the correct time. Two sound tracks of the voice are placed on a revolving drum. On one track are recorded hours, on the other minutes. Parallel to the drum are two photo-electric cells, seen in the picture in their semi-cylindrical coverings. Under the photo-electric cells and parallel to the drum is a lamp which throws a narrow beam on that part of the sound tracks near the photo-electric cells. Altering in accord with the sound vibrations (modulated), the light from the sound tracks on the drum is reflected into the photo-electric "eyes." The light waves are converted into electric waves, which, after amplification, are transmitted by means of a relay (not visible in the photo) to the telephone line. The slow turning of the drums is synchronised with a clock. A number of identical machines are to be made this year.

A Tramways Association

The Light Railway and Transport League has been formed to cater for those interested, whether in a professional capacity or otherwise, in tramways and in railways of the non-standard kind. It aims at showing transport in a proper perspective, in which every type of vehicle is given its proper place, which entails a willingness on the part of transport authorities to adapt the tramcar to modern conditions. Further information may be had from Mr. S. G. Jackman, 1a, St. Margaret's Avenue, South Harrow, Middlesex, or from Mr. J. W. Fowler, 245, Cricklewood Broadway, London, N.W.2.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—May 18th. Borough Council. Cable and meters for one year. (See this issue.)

Australia.—MELBOURNE.—June 1st. State Electricity Commission of Victoria. A.c. commutator motors and control equipment. (T.Y. 31318.)* Magnetic separator drum, with suitable motor generator set, or alternatively, rectifier unit, and control equipment. (April 30th.)
June 29th. Industrial electric heating apparatus. (T. 2504.)*
July 6th. 22,000-V outdoor switchgear and accessories. (T.Y. 31309.)*

Barking.—May 24th. Borough Council. Electrical installations in flats and houses in Ripple and Abbey Roads. (See this issue.)

Beckenham.—May 31st. Borough Council. Seven three-phase transformers. (April 30th.)

Bingley.—May 11th. U.D.C. Electricity Department. One 200-kVA indoor type transformer. (April 23rd.)

Birkenhead.—May 14th. Corporation. L.v. main switchboards, with high rupturing capacity fuses, for nine months from July 1st. Borough electrical engineer, Craven Street.

Blackpool.—May 8th. Borough Council. Two electrically driven vertical spindle centrifugal pumps (200-gal. per min. each), with starters, &c., for the Anchorsholme pumping station. Borough engineer, Municipal Buildings, Talbot Square (deposit £1).

Bradford.—May 17th. Transport Committee. Fifteen, forty-two and fifty-seven double-deck trolley-buses complete, or alternatively, similar numbers of (a) double-deck trolley-bus chassis complete with electrical equipment and (b) all-metal double-deck trolley-bus bodies. Transport general manager, 11, Forster Square.

Bristol.—May 10th. Corporation. Switchgear and transformers. (April 30th.)

Cardiff.—May 20th. Electricity Department. One 15,000-kVA 3-phase transformer and 33,000-V and other p.i. cables. (April 30th.)

Chesterfield.—May 8th. Electricity Committee. Cables. (April 30th.)

Darlington.—June 5th. Corporation. 20,000-kW turbo-alternator, with condensing and other ancillary plant. (April 30th.)

Dundee.—May 17th. Education Committee. Electric lighting at St. Michael's Central school. City quantity surveyor, 21, City Square.

East Retford.—May 20th. Borough Council. One h.v. testing equipment. (See this issue.)

Epsom and Ewell.—May 18th. U.D.C. Electricity Department. H.v., p.i., l.c. and double steel tape armoured cable. (See this issue.)

Falkirk.—May 17th. Town Council. Electric radiators for Blinkbonny Home. Town clerk.

Fareham.—May 27th. U.D.C. Borehole type, electrically driven centrifugal pumps, with the necessary switchgear, at the Maindell pumping station. Taylor & Wallin, 1, Saville Place, Newcastle-upon-Tyne (deposit £10).

Fife.—May 18th. County Council. Electrical and heating work at the new County Library, Kirkcaldy. Particulars from G. Sandilands, county master of works, Property and Works Department, County Offices, Wemyssfield, Kirkcaldy (deposit £1 1s.). by May 8th.
May 17th. Electric lighting in eighty houses at North Glencraig. C. R. Douglas & Son, surveyors, 15, East Port, Dunfermline (deposit £1 1s.).

Great Crosby.—May 31st. U.D.C. Four electrically driven centrifugal pumps of 1,850-cu. ft. per minute capacity, with ancillary plant, &c. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £5 5s.).

Hastings.—May 26th. Borough Council. Boiler fuel suitable for use with mechanical stokers, at the Broomgrove power station. (April 23rd.)

Hull.—May 10th. Committee of Visitors of the Mental Hospital. Two electrically driven washing machines. Clerk and steward of the Mental Hospital, Willerby, near Hull.

Ilford.—May 7th. Borough Council. Electrical machinery for the timber mill at the Lev Street depôt. L. E. J. Reynolds, borough engineer, Town Hall.

India.—SIMLA.—May 18th. Stores Department. One 60-kW shunt-wound, 460/500 V, d.c. crude-oil engine-driven generating set. (T.Y. 31326.)*

Irish Free State.—PORTLAOIGHISE.—May 12th. District Mental Hospital Committee. Electrical installation in connection with the proposed extension and alterations scheme at the Hospital. P. J. Sheahan, 47, O'Connell Street, Limerick (deposit £5).
DUBLIN.—June 15th. Electricity Supply Board. One 10,000-kVA transformer, with on-load tap-changing equipment. (See this issue.)

Lancashire.—May 29th. County Council. Electrical installations for the new medical administration block, kitchen block and covered ways at Whiston Institution, near Preston. Particulars from S. Wilkinson, county architect, County Offices, Preston (deposit £2), by May 8th.

Lancaster.—Electricity Department. Cables. (April 30th.)

Lewes.—May 21st. Town Council. Electric passenger lift at the Council Offices. C. T. Butler, borough surveyor, Town Hall (deposit £1 1s.).

Leyton.—May 13th. Corporation. P.i., l.c. cable. (See this issue.)

Lochgelly (FIFE).—May 17th. Town Council. Electric lighting in eighty houses. J. Gentles & Son, surveyors, Central Chambers, Kirkcaldy (deposit £1 1s.).

London.—ST. MARYLEBONE.—May 25th. Borough Council. 11-kV metal-clad switchgear. (See this issue.)

Magor and St. Mellons.—May 14th. R.D.C. Automatic electrically driven water booster plant, consisting of duplicate sets of turbine pumps and motors, air compressor, starters, switches, &c., for the Derwallt water supply, Rogerstone. Thomas & Morgan & Partners, engineers, 23, Gelliwastad Road, Pontypridd (deposit £2 2s.).

Middlesex.—May 24th. County Council. Electrical installation at the new elementary school, Hewens Road, Hayes. (April 23rd.)

Morecambe and Heysham.—May 24th. Borough Council. Decorative illuminations at the super swimming stadium. (April 30th.)

Newcastle-upon-Tyne.—City Council. Electric lighting installations at the Cambridge Street and Delaval schools. T. Walling, director of education, Northumberland Road.

New Zealand.—WELLINGTON.—June 14th. Post and Telegraph Department. Insulated copper wire. (T.Y. 31349.)*
July 6th. Public Works Department. 110-kV and 66-kV outdoor switchgear and steelwork. (T.Y. 31347.)*

Northern Ireland.—BELFAST.—May 18th. Electricity Committee. Electrically driven centrifugal drainage pump and pipework; static transformers, switchgear and interconnecting cables, mercury arc rectifier equipment, and construction of sub-station building. (April 30th.)

Norwich.—Committee of Visitors of the St. Andrew's Hospital. Automatic telephone equipment at the Hospital. (See this issue.)

Oldbury.—June 7th. Education Committee. Electrical wiring at Moat Farm schools. Particulars from the Education officer, Municipal Bank Chambers (deposit £2 2s.), by May 8th.

Plymouth.—May 8th. Corporation. L.v. underground joint boxes. (April 23rd.)
May 15th. Conversion to a.c. of a 5-h.p. d.c. goods lift. (April 30th.)
May 19th. H.v. underground pilot cables. (See this issue.)
May 29th. Electrically operated jib cranes. (April 30th.)

Reigate.—May 13th. Borough Council. Three sheet steel kiosks, with e.h.v. and l.v. switchgear and transformers; kettles, meters, and l.v. underground link and joint boxes. (April 30th.)
May 20th. Four 400-kVA and two 300-kVA transformers. (See this issue.)

Sheffield.—May 15th. Electricity Committee. Coal-handling plant. (April 30th.)

Sleaford.—May 10th. U.D.C. Electricity Department. Steel kiosk and e.h.v. switchgear, l.v. switchboard and 200-kVA transformer. (April 23rd.)

South Africa.—JOHANNESBURG.—May 15th. City Council. Distribution units equipped for cartridge fuses. (T. 31310.)* L.v. metal-clad switchboards. (T.Y. 31314.)*
June 19th. Electric lamps for twelve months, including lamps for street lighting. (T. 31343.)*
CAPE TOWN.—May 13th. Electricity Undertaking. Insulators. (T.Y. 31304.) Pole fittings. (T.Y. 31350.)* Steel electric lighting poles. (T.Y. 31307.)* Transformers. (T.Y. 31313.)*
PRETORIA.—May 28th. Union Tender and Supplies Board. 500 telephotometers. (T.Y. 31303.)*
May 21st. Public Works Department. 200-kVA transformers, l.v. switchgear and cable. (T.Y. 31333.)*

Southampton.—May 18th. Electricity Department. Coal storage handling plant. (April 30th.)

Southend-on-Sea.—June 3rd. Borough Council. 11-kV metal-clad switchgear equipment. (April 23rd.)

Swindon.—May 28th. Electricity Department. Transformers, switchgear, extensions to 6.6-kV switchboard, alterations to 6.6-kV cubicle in kiosk sub-station and an outdoor kiosk-type sub-station. (See this issue.)

Uruguay.—MONTEVIDEO.—June 14th. State Electricity Supply and Telephones Administration. Protective equipment against excess voltage for a 6/33-kV transforming station and two tapping posts of a 33-kV overhead power transmission line. (T.Y. 31344.)*
July 5th. R.i. copper conductors and flexible cords. (T.Y. 31351.)*

Wallasey.—May 18th. Borough Council. Cables and meters for twelve months. (April 23rd.)

Walton and Weybridge.—May 18th. U.D.C. Electricity Department. Cables for one year. (April 30th.)

Wick.—May 8th. Town Council. Electric lighting in five blocks of houses. Burgh surveyor (deposit £2 2s.).

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* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barking.—Electricity Committee. Recommended. Seven 400-kVA transformers (£2,034).—British Electric Transformer Co. Equipment for street lighting (£926).—Siemens Electric Lamps & Supplies.

Cheltenham.—Electricity Committee. Accepted. Erection of overhead line to Gotherington (£1,354).—B.I. Cables.

Dover.—Town Council. Accepted. Alterations to or replacement of consumers' apparatus owing to the change-over (£258). W. Jay. Similar work in connection with electric motors on consumers' premises (£179).—Higgs Motors, Ltd.

Eccles.—Electricity Committee. Accepted. Two 250-kVA transformers (£420).—Electric Construction Co. Two e.h.v. ring main control units (£484).—Ferguson, Pailin. Switchgear (£373).—English Electric Co.

Finchley.—Electricity Committee. Recommended. Transformers.—Bruce Peebles & Co. Kiosks.—A. Reyrolle & Co.

Glasgow.—Transport Committee. Accepted. Materials in connection with the construction of 100 tramcars: Bell pushes, direction indicators and dash lamps.—T. Scott & Co. Stop light switches and platform brake gear.—Maley & Taunton. High-voltage switches and windscreen wipers.—J. Robertson.

Libraries Committee. Accepted. Electrical installation at the Riddrie Library (£328).—Woodward, Sons & Co.

Hull.—Education Committee. Accepted. Electric lighting and heating installation at Kingston High school (£2,084).—Northern Electrical Co.

Ipswich.—Electricity Committee. Accepted. Transformers: Twelve 250-kVA (£195 each), four 500-kVA (£299 each), two 500-kVA, fitted with choke coils and suitable for subsequently fitting on-load tap changing equipment (£361 each), and one 1,000-kVA (£571).—G.E.C.

London.—METROPOLITAN WATER BOARD.—Electric goods lift at the Battersea works:

	£		£
Harrysat & Scott. Accepted ...	**489**	Porn & Dunwoody	564
J. & E. Hall	506	Penrose Lifts	605
Waygood Otis	546		

L.C.C.—Housing and Public Health Committee. Recommended. Extension of the existing contract for wiring and fittings for electric lighting, &c., in blocks 3, 5, 6, 8 and 9 of dwellings on the Sumner Road area, Camberwell, to include the electrical installations in blocks 1, 2 4 and 7 of dwellings on the area (£2,242).—Buchanan & Curwen, Ltd.

Wiring and fittings for electric lighting, etc., in blocks 1, 2, 3 (part) and 4 to 10 of dwellings on the Pembury Road estate, Hackney:

	£		£
Holliday and Son (Electrical) Accepted	**3,200**	Anderson, Angell and Co. ...	3,796
Archibald Meckhonik	3,319	Read and Partners	3,847
Carr Brothers	3,424	G. E. Taylor and Co.	4,022
Electrical Installations	3,543	Atozed (Kingston)	4,205
City Electrical Co.	3,628	Samuel Reed and Sons	4,420
Jacob, White and Co.	3,640	B. French	4,436
Coleby and Co.	3,665	Francis Polden and Co.	4,629

Manchester.—Electricity Committee. Recommended. Static transformers for twelve months.—Ferranti, Ltd. Portable Venturi meter for boiler testing at the Barton power station.—George Kent, Ltd. Neutral earthing resistors.—B.T.H.; Ferguson, Pailin. L.v. cables.—Mersey Cable Works; Hackbridge Cable Co.; Connollys (Blackley), Ltd.; B.I. Cables. Two 2,000-kVA transformers.—Met.-Vick. Elecl. Co.

Middlesex.—Health Committee. Recommended. Telephone cable at West Middlesex County Hospital (£145).—Page & Girling. Rewiring mansion at Clare Hall Sanatorium:

	£		£
G. A. Weston. Accepted ...	**333**	Page & Girling	396
Rawlings Bros.	352	North Metropolitan Electric Power	
Read & Partners	383	Supply Co.	616
T. Clarke & Co.	387	Burdette & Co.	616
G. E. Taylor & Co.	390		

General Purposes Committee. Accepted. Main switchgear installation at Central Hospital (£1,150).—Johnson & Phillips. Lifts at Redhill Hospital (£3,163).—Pickerings, Ltd.

Salford.—Light, Heat and Power Committee. Accepted. Electric cookers during the period ending March 31st, 1938 (£3,180).—Walker Hunter & Co. 33,000-V feeder cables and pilot cables from the Agecroft power station to the Scholes Lane sub-station, Prestwich (£11,612).—W. T. Glover & Co.

Sheffield.—Electricity Committee. Accepted. Six three-phase, 500-kVA transformers (£1,680).—Electric Construction Co. Transformers (£1,234).—Rissik Long & Co. Sub-station switchgear (£7,823), 11-kV neutral earthing equipment (£645), switch modifications (£1,344), and one 33-kV switch equipment (£7,075).—A. Reyrolle & Co.

Staffordshire.—Education Committee. Accepted. Electric lighting and power at a new school at Caverswall Cellarhead (£437) and at the senior mixed school at Endon (£452).—J. Bagguley & Son.

Stoke-on-Trent.—Works Committee. Accepted. Electrical goods for twelve months.—G.E.C.

Forthcoming Events

Institution of Electrical Engineers.—*(Meter and Instrument Section).*—Friday, May 7th. 4 p.m. Visit to the Holborn Telephone Exchange to inspect the "speaking clock," and other items of engineering interest. 7 p.m. Institution, London, W.C.2. "Fundamental Electrical Measurements." Sir Frank E. Smith. Saturday, May 8th. Summer visit to part of the area of the North Metropolitan Electric Power Supply Co.

Birmingham Electric Club.—Friday, May 7th. Summer visit to the Rugby works of the British Thomson-Houston Co. and the wireless transmitting station at Hillmorton.

Physical Society.—Friday, May 7th. Imperial College of Science and Technology, London, S.W.7. 5.15 p.m. Papers will be read and a demonstration given.

Royal Institution.—Friday, May 7th. Institution, London, W.1. Conversazione.

Notes

Daylight Illumination

The amount of the daylight illumination that ought to be provided for clerical workers is becoming of increasing importance in designing an office building. A report issued by the Department of Scientific and Industrial Research (Illumination Research Technical Paper No. 19, "Daylight Illumination Necessary for Clerical Work," published by H.M. Stationery Office, price 6d. net) describes an investigation into the problem carried out by the National Physical Laboratory in which a mechanical method was used for the first time to find the value of daylight illumination below which the average worker would turn on artificial light. The results indicate that some of the minimum standards of illumination suggested in the past are too low. Typists, for example, seem to need a daylight illumination of at least 5 ft. candles. The experiment was made in a room in a Government office containing eighteen typists, each of whom had a separate desk lamp. When any typist switched on her lamp the current through it automatically actuated a cinematograph camera, which took photographs of the scale of a micro-ammeter connected to a photo-electric cell placed against a window, and on the same film indications were also recorded showing which typist had switched on her light, the time of day and the date.

Electricity on the Farm

That electricity may be regarded as economical for lighting at 6d. per kWh is the opinion expressed in an article in the *Farmer and Stock-Breeder*, which deals with the question of cost from the farmer's point of view. For small pumps, bottle washing and milk cooling, the economic rate is not much less, apart from labour saving and convenience, but for larger motors (where the internal-combustion engine is in competition), no more than 1d. per kWh is feasible as a rule. At the same price electricity can be used for heating for short periods only, or in confined spaces, such as incubators, and where thermostatic control is required; likewise if steam and hot water are required for one operation of sterilising and washing up morning and evening, cleanliness and convenience being regarded as additional assets. In a typical case the kWh consumed in a year for various items is given as lighting, 350; cooking, 2,000; milking (1 h.p., 4 hrs. per day), 1,400; bottle washing (½ h.p., 2 hrs. per day), 150; grinding (7½ h.p., one day per week for six months), 1,300; deep-well pumping (2 h.p., 3 or 4 hrs. per day), 2,200; total, 7,400. With annual fixed charges of £8 for the house and £5 for the farm, plus 1d. per kWh, the total cost is £43 16s. 8d., averaging about 1.4d. per kWh. It is pointed out that this average price does not represent the cost of additional energy required—simple enough, but often misunderstood—and the advantages of the two-part tariff are explained. With electricity at 2d. per kWh, the cost of electricity for raising 1,000 gal. per hr. through a 200 ft. lift is 4d.; adding 4d. for interest and depreciation of plant brings the total to 8d. per 1,000 gal., which is considered cheap. The same price is acceptable for a milking machine and for bottle washing. Taking grinding, cooking and large power at ½d. per kWh, the total cost of electricity (including lighting at an economic rate) works out at the same figure as under the two-part tariff.

Appointments Vacant

Technical assistant for Aberdeen Electricity Department.

Assistant in the mains department, Barrow-in-Furness.

Civilian wireless instructors at the Electrical and Wireless School, R.A.F., Cranwell.

Commercial assistant for Barnstaple.

Meter superintendent for Carlisle electricity undertaking.

Lady demonstrator for the Trent Valley and High Peak Electricity Co., Ltd.

Assistant engineer for the Posts and Telegraphs Department, Kenya, Uganda and Tanganyika.

Electrician for the County Sanatorium, Harefield, Middlesex.

Cable jointer for Malvern Electricity Department.

Outside representative for Walthamstow Electricity Department.

Assistant engineer for Woolwich Electricity Department.

Sales assistant for Worcester Electricity Department.

Installations engineer for Hackney Electricity Department.

(See our classified advertisements.)

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

15-A d.p. Switchplug bearing the monogram "H D."

WATT-A-LITE reflectors.

WICKSTEAD bread buttering and slicing machine.

CICLONE ceiling fans.

SILVERTONE electric bell.

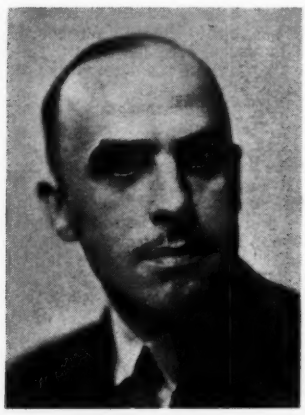
PRINCESS electric washing machine.

Readers should enclose stamped addressed envelopes when making their inquiries.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. A. G. Beaver, of the Sun Electrical Co., past-president of the Radio Wholesalers' Federation, was presented with a framed photogravure of himself at the annual luncheon of the Federation held at the Connaught Rooms on April 28th. Mr. Beaver has given the portrait to the Federation.



Mr. G. S. Bone

Mr. G. S. Bone has been appointed showroom and sales manager to the Borough of Brentford and Chiswick Electricity Department. For the past four and a half years he has occupied the position of showroom superintendent to the Borough of Ealing Electricity Department, and has held similar appointments with the County Borough of Barrow-in-Furness and the Borough of Scunthorpe Electricity Departments. On his departure Mr. Bone was presented with an electric granddaughter clock presented by Mr. R. Birt on behalf of the staff of the Ealing undertaking.

Mr. R. M. Gravett, assistant sub-station engineer at Wolverhampton, has obtained a position with the Shropshire, Worcestershire and Staffordshire Electric Power Co.

Mr. J. E. Rapp has been appointed a sales representative in the southern counties for Berry's Electric, Ltd.

Mr. J. E. Rapp

Mr. J. E. R. Crawford has recently been appointed service and export manager of C.A.V.-Bosch, Ltd., while Mr. B. L. Page, who formerly held this position, has taken over another department. Mr. Crawford will, in future, control all service arrangements in this country and overseas for both electrical and fuel injection equipment; in addition, he will be responsible for the export sales organisation. **Mr. Cecil H. Broadhurst** has been appointed advertising manager.

Mr. Walter F. Higgs, M.I.E.E., who was elected M.P. (National Unionist) for West Birmingham last week, to fill the vacancy caused by the death of Sir Austen Chamberlain, is governing director of the well-known company, Higgs Motors, Ltd., electric motor manufacturers, of Birmingham,

[Elliott & Fry [Lafayette

Two new M.P.s connected with the electrical industry: Left, Mr. H. B. T. Cox (Stalybridge). Right, Mr. W. F. Higgs (West Birmingham)

of which business he was also the founder. He is a member of the Birmingham Corporation and is fifty-one years of age.

Mr. H. B. Trevor Cox, who was also returned last week as National Unionist Member for Stalybridge, is the son of Mr. C. H. Cox, director of the Edison Swan Electric Co., Ltd. He was born in 1908, and an account of his early career in studying public and electrical industrial affairs in various parts of the world was given in the ELECTRICAL REVIEW for March 29th, 1935 (page 470), when he was invited to stand for North-East Derbyshire.

Mr. J. W. Howell, who has served for four years as the industrial specialist of the E.L.M.A. Lighting Service Bureau, London, has been appointed to take charge of the new branch office which was opened on Saturday last at 10, Apson Chambers, 68, Albion Street, Leeds. Mr. Howell received his training at the Loughborough College of Engineering, and in 1923 he joined the General Electric Co., Ltd., as draughtsman designer at Birmingham. He entered the service of the Lighting Service Bureau in 1933. Mr. Howell has carried out investigations into the lighting of mines, and recently he read a paper on this subject before the Illuminating Engineering Society.

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Mr. J. W. Howell

Mr. W. J. Eves retired on April 30th from the position of Post Office Area Engineer for the North of Scotland after forty-five years' service. He was entertained to dinner and received gifts from colleagues.

Dr. R. A. Millikan, executive head of the California Institute of Technology, has been awarded the Franklin Medal. The *Electrical World* says that the award is made "in recognition of his isolation and measurement of the fundamental unit of electricity, the electron; the photo-electric determination of the fundamental constant of radiation, Planck's constant; the extension of the ultra-violet spectrum by two octaves to join the spectrum of soft X-rays, and the study of the nature and the properties of a very penetrating radiation of cosmic origin."

Mr. G. A. Hall has been appointed to the newly created position of sales and production manager for Ferranti car radio. Mr. Hall, who is the son of the chief radio engineer to Ferranti, Ltd., Mr. A. Hall, has been with the company for a number of years, both on inside production and latterly as a radio representative for the Midland sales area. The appointment takes effect at once, but Mr. Hall's successor has not yet been appointed.

Mr. G. A. Hall

Mr. T. K. Fell has resigned his position with the Jackson Electric Stove Co., Ltd., as outside representative in the North Wales area, and **Mr. C. L. Brown** has been appointed to take over this district.

Major E. Ivor David has been awarded the Gold Medal of the South Wales Institute of Engineers for a paper on "Air Compression, Transmission and Metering" as the best contribution to the Institute's proceedings during 1936-37. Major David is also a gold medallist of the Institution of Electrical Engineers and of the Association of Mining Electrical Engineers.

M. C. W. Eve has been appointed an additional director of Kolster-Brandes, Ltd.

Mr. J. F. Lincoln, president of the Lincoln Electric Co., in whose honour the company has established the James F. Lincoln Arc Welding Foundation, is to visit England during the latter part of this month or early in June. The Foundation will sponsor an arc welding prize contest, offering rewards totalling $200,000. The object of the contest is to encourage and stimulate interest in the development of the arc welding industry.

Mr. C. W. Hanson, who until recently was press officer of the Crompton Parkinson-British Electric Transformer-Derby Cables group, has set up in business on his own account as a specialist in engineering and technical advertising at 39a, Mecklenburgh Square, W.C.1.

Mr. S. M. Richardson, who has been appointed manager of the Melbourne and Metropolitan Tramways Board to succeed the late Mr. A. D. Murdoch, has been with the tramway service for more than twenty-five years, and has been assistant manager since August, 1935. He was born in England, and went to Australia in his youth.

Obituary

Mr. Robert L. Acland.—We regret to record the death of Mr. Robert Lawford Acland, M.I.E.E., which occurred on April 30th. Mr. Acland was chief engineer and tramways manager to the Chesterfield Corporation for a number of years, and in 1929 he went to India to collect information for a report on a scheme of co-operative publicity suitable for Indian electricity supply undertakings under the control of the British Indian Electric Committee. Since then he has been on the staff of the British Electrical Development Association responsible for matters concerning the development of trolley-buses and electric vehicles. He was assistant secretary of the Electric Vehicle Committee of Great Britain, Ltd.

[*Elliott & Fry*

The late Mr. R. L. Acland

Mr. E. R. Appleyard.—The many friends of Commander Rollo Appleyard, will, we are sure, join with the ELECTRICAL REVIEW in expressing deep sympathy with him and with Mrs. Appleyard on the death of their only son, Edward Rollo, which occurred in a nursing home on May 3rd at the age of 34 years.

Mr. A. D. Murdoch, manager of the Melbourne and Metropolitan Tramways Board, died recently after an illness of a few days states the *Electrical Engineer and Merchandiser* (Australia). Mr. Murdoch was born in England, and served his apprenticeship with Dick Kerr & Co., Ltd. He went to Australia about thirty years ago to supervise tramway construction for the North Melbourne Electric Tramways & Lighting Co., Ltd., and later became manager of the undertaking. When the North Melbourne tramways were taken over by the Metropolitan Tramways Board he joined the staff of the State Electricity Commission. In October, 1923, he was appointed manager of the Tramways Board.

Mr. W. A. Bacon, whose death occurred recently at the age of seventy-seven, was formerly manager of the Southampton branch of Siemens Bros. & Co., Ltd., Woolwich. He joined the company in 1883 at the Woolwich works, and was transferred to Queen Anne's Gate in 1897. Two years later he returned to Woolwich, and in 1903 was appointed branch manager at Bristol, being transferred to Southampton in 1916. He retired in 1921. Mr. Bacon went to Ireland on the *Faraday* when the Mackay-Bennett cables were laid.

Mr. J. F. Monnot.—The death occurred recently in France, at the age of 71 years, of Mr. J. F. Monnot. From 1913 to 1929, he was managing director of the Edison Accumulator Co., Ltd., London, and introduced Edison batteries into Europe.

Mr. B. J. Jacobs.—The death occurred recently at Yeovil, at the age of seventy-seven, of Mr. Benjamin Joseph Jacobs, who, in collaboration with Sir Ernest Petter and Mr. P. W. Petter, built what is claimed to have been the first internal-combustion-engined motor car in this country. Mr. Jacobs was the first chief designer of Petters, Ltd., and was still associated with the company at the time of his death.

Will.—**Mr. F. C. C. Milson,** formerly manager of the Great Northern Telegraph Co., of Denmark, left £22,673, with net personalty £22,468.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Boon & Martin, Ltd.—Private company. Registered April 28th. Capital, £100. Objects: To carry on the business of electrical engineers, wireless and television merchants, builders, &c. The directors are: R. F. Boon, 123, West Street, Portchester, Hants, and R. C. W. Martin, 63, Baffins Road, Portsmouth. Registered office: 123, West Street, Portchester, Hants.

North British Electric Welding Co., Ltd.—Private company. Registered in Edinburgh April 30th. Capital, £2,000. Objects: To carry on the business of welders of metals by electrical and other processes, electrical and mechanical engineers, &c. The subscribers are: J. M. Russell, 29, Holytown Road, Mossend, Bellshill, Lanarkshire, and G. M. Findlay, Beechwood Crescent, Gavin Street, Motherwell.

Harries & Adams, Ltd.—Private company. Registered May 1st. Capital, £2,000. Objects: To acquire the goodwill of the business of radio dealers and engineers carried on by E. Harries at 79, Cranbrook Road, Ilford, as Edwards & Co. The directors are: E. Harries, 351, Wanstead Park Road, Ilford, and S. E. Adams, The Chantrey, Woodmancote, near Henfield. Registered office: 79, Cranbrook Road, Ilford.

Geo. W. Bentley, Ltd.—Private company. Registered April 30th. Capital, £3,000. Objects: To carry on the business of electricians and general electrical engineers, &c. The directors are: G. W. Bentley and Mrs. C. A. Bentley, both of "Heatherley," 5, Bellair Road, Havant, Hants, and two others. Secretary: C. A. Bentley.

Thos. Sloan, Ltd.—Private company. Registered April 29th. Capital, £500. Objects: To carry on the business of electrical engineers, contractors, merchants, haulage and cartage contractors, factors and wireless manufacturers, &c. The directors are: T. Sloan (governing director) and C. M. Sloan, both of 59, Swaledale Gardens, Heaton, Newcastle-on-Tyne, 7. Registered office: 31, Oxford Street, Newcastle-on-Tyne, 2.

Keith Engineering Co., Ltd.—Private company. Registered April 29th. Capital, £1,000. Objects: To carry on the business of electrical engineers and general electrical installation contractors, lighting specialists and contractors, mechanical and aeronautical engineers, &c. The directors are: A. Drummond, 59, Dalton Green Lane, Huddersfield; J. R. Stocks and H. T. Stocks, both of 37, Mayfield Avenue, Dalton, Huddersfield. Solicitors: Marshall Hall & Lister, 34, New Street, Huddersfield.

B. Berger & Co., Ltd.—Private company. Registered April 28th. Capital, £500. Objects: To carry on the business of manufacturers of electric light reflectors, general and electrical engineers, solderers, metal founders, sheet and metal workers, manufacturers of radio and electrical components, &c. The subscribers are: B. Berger and M. Berger, both of 306, City Road, E.C.1. Registered office: 306, City Road, E.C.1.

Borough Electric, Ltd.—Private company. Registered April 29th. Capital, £500. Objects: To carry on the business of merchants, manufacturers, importers and exporters of, agents for and dealers in electrical appliances and sundries, radio and television apparatus, refrigerators, &c. The directors are: C. J. Marshall, 158, Tanfield, N.W.2; and N. H. A. Harris, 158, Galliard Road, N.9. Registered office: 15, New Bridge Street, E.C.4.

Northern Electric (London), Ltd.—Private company. Registered April 26th. Capital, £2,000. Objects: To acquire the business of an electrician, electrical, lighting, heating, mechanical and general engineer and engineering contractor and manufacturer and worker of and dealer in electricity, motive power and light now carried on by D. A. Abbott at Portland Chambers, Portland Street, Manchester, as Northern Electrical Co. The subscribers are: D. A. Abbott, 9, Winkarleigh Street, Warrington; and G. W. Morton, 3, Burford Lane, Lymm, Ches. D. A. Abbott is permanent director and chairman. Solicitors: Thomas Ridgway & Co., 21, Palmyra Square, Warrington.

Returns of Electrical Companies

Metropolitan Electric Supply Co., Ltd.—Satisfaction in full on January 1st, 1937, of mortgage (supplemental to a trust deed dated July 20th, 1894) dated August 5th, 1904, and registered August 17th, 1904, securing £250,000 first mortgage debenture stock. (Notice filed April 24th, 1937.)

North Wales Power Co., Ltd.—Satisfaction to the extent of £300,000 on April 4th, 1937, of a series of debentures authorised by resolution dated May 1st, 1930, and registered May 5th, 1930. (According to the register of mortgages the series of debentures registered May 5th, 1930, originally secured £300,000.)

St. Mary's (Scilly) Electricity Supply Co., Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated April 19th, 1937, to secure £5,000. Holders: Crescent Trade Facilities, Ltd., 13, Grosvenor Crescent, Hyde Park Corner, S.W.1.

Yorkshire Telephone Systems, Ltd.—The nominal capital has been increased by the addition of £2,000 in £1 ordinary shares beyond the registered capital of £1,000.

T. H. Satchwell, Ltd.—E. P. Major, of 89, Cornwall Street, Birmingham, was appointed receiver and manager on April 22nd, 1937, under powers contained in debenture dated May 18th, 1936.

Arvin Electric, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated April 20th, 1937, to secure £500 and such further sums as shall from time to time become owing. Holder: M. H. Thorp, 79, Salisbury House, E.C.2.

St. Austell and District Electric Lighting & Power Co., Ltd.—Mortgage on 9, Fore Street and 1, Vicarage Hill, St. Austell, dated September 20th, 1935, to secure £5,000. Holders: Hean Castle Estate Co., Saundersfoot, Pembrokeshire. Registered April 23rd, 1937, by permission of the Court.

Bustler Electric Co. (London), Ltd.—Debenture charged on the company's undertaking and assets, dated April 19th, 1937, to secure £1,000. Holder: R. H. Edwards, 3, Hinds Road, Harrow.

Aerialite, Ltd.—Mortgages and debenture charged on Castle Ironworks, Acres Lane, Stalybridge, with plant and machinery and three yearly rent charges, and the company's undertaking and property, present and future, including uncalled capital, dated April 13th, 1937, to secure all moneys due or to become due from the company to District Bank, Ltd.

Neon (Portsmouth), Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated April 12th, 1937, to secure £2,000 (ranking *pari passu* with existing debenture for £1,500). Holders: Branch Nominees, Ltd.

Lionel Robinson & Co., Ltd.—Mortgage on 25, Atherton Street, Liverpool, dated April 13th, 1937, to secure £500. Holders: Clonmany Estates, Ltd., 14, South Square, Gray's Inn, W.C.1.

Kartret Switchgear Co., Ltd.—Capital, £2,500 in £1 shares. Return dated January 1st, 1937. All shares taken up. £2,500 considered as paid. Mortgages and charges, nil.

Selfix Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 6th, 1937. 691 shares taken up. £335 paid. £356 considered as paid. Mortgages and charges, nil.

Bray, Markham & Reiss, Ltd.—Capital, £20,000 in 10,000 6 per cent. preference and 10,000 ordinary shares of £1. Return dated December 29th, 1936. 7,080 ordinary and 10,000 preference shares taken up. £16,080 paid on 10,000 preference and 6,080 ordinary shares. £1,000 considered as paid on 1,000 ordinary shares. Mortgages and charges, nil.

General Wireless Relay Co., Ltd.—Capital, £25,000 in 20,000 preference shares of £1 and 100,000 ordinary shares of 1s. Return dated August 13th, 1936 (filed February 15th, 1937). 6,007 preference and 100,000 ordinary shares taken up. £11,007 paid. Mortgages and charges £5,300.

Camberwell Relay Service, Ltd.—Capital, £5,000 in £1 shares. Return dated December 9th, 1936. All shares taken up. £5,000 paid. Mortgages and charges nil.

Electraulic Presses, Ltd.—Capital, £100 in £1 shares. Return dated January 14th, 1937. All shares taken up. £2 paid, £98 calls unpaid. Mortgages and charges nil.

London & Provincial Electrical Co., Ltd.—Particulars filed of £400 debentures authorised April 14th, 1937, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

City Notes

W. T. Henley's Telegraph Works Co., Ltd.—Presiding at the annual meeting held on Friday last Sir Montague Hughman (chairman) said that the year 1936 was a memorable one, for not only was it the centenary year of the company but it showed Henley's at the peak of their prosperity; all records of numbers employed, of output in tonnage and mileage and of net profits had been beaten. To commemorate the completion of one hundred years of the business a centenary bonus was paid to the staff and workpeople while a bonus issue of one ordinary share for every ordinary share held was made to the shareholders on the register at December 31st. During the current month the Duke of Kent performed the opening ceremony of the new building at their Woolwich works. A special study of the problem of overseas trade had been made, and in the past year this side of their business was nearly 28 per cent. of their total trade. With regard to the expansion in profits they had not increased prices beyond the minimum required to cover additional costs due to rising prices of materials. During the year they had experienced remarkable variations in the prices of such commodities used in their business as copper wire bars, Colonial lead and rubber. The execution of several large extra-high-voltage cable orders had involved continuous co-operation between the laboratories and the factory. Investigations into the problems of new raw materials continued to be of importance and had resulted in further valuable applications. The result of long research carried out during the year by the technical staffs of the members of the Cable Makers' Association had been the issue of a new set of standards for rubber cables. Co-operation had also taken place between their technical departments and other important bodies, resulting in new and revised specifications for national and international use. This work was still proceeding and would inevitably lead to a reduction in number of types and sizes of electric cables. Capital had been allocated for the purchase of apparatus and plant for the provision of adequate cable testing facilities. One particular type of testing equipment which had been developed by one of their own technicians promised to revolutionise the method of testing rubber insulated cables. The extension at North Woolwich was completed and was equipped with machinery embodying features of their own design, much of which was being made in their own workshops. Plans had been made for further extensions at Gravesend, and they were now carrying out additions to their extra-high-voltage cable plant which they hoped would be completed in the current year. Their engineering and contract departments showed a satisfactory increase in business. With regard to their subsidiaries, the Henley's (South Africa) Telegraph Works Co. had experienced another successful year, and while the Holborn Construction Co. had sustained a very small loss it was growing rapidly and had started the present year with a considerable increase in the value of contracts in hand. The Tyre Company had realised a substantial increase in turnover. With regard to the future they had started the current year with some substantial orders in hand, and the value of orders received to date exceeded all their previous records. Sir Montague then expressed the view that industry could bear without serious injury the amount required each year by the Chancellor of the Exchequer for a National Defence Contribution, and suggested that the Chancellor should consider the question of inserting in his Finance Bill a clause to the effect that if the tax yield more than the sum required per annum the surplus should be returned *pro rata* to those who paid the money. This could be done by adjustment in subsequent tax payments of the companies concerned. Mr. W. F. Bishop (managing director) said that contracts for 66,000-V oil-filled cables for the County of London Electric Supply Co. and the Borough of Fulham had been completed, and further contracts were received from Fulham, including the supply and installation of cables for the new Earl's Court Exhibition buildings. They had carried out a good share of underground and overhead work for the Central Electricity Board and had completed the 167½ miles of 66,000-V transmission line in India. They had now in hand a further 110 miles of similar work for the same undertaking in India and eighty-five miles of 33,000-V and 11,000-V lines were under construction for another customer in that country. Their associated company, the Henley Extrusion Machine Co., had received a number of orders for continuous lead extruding machines from home and abroad, and they could look forward to a satisfactory development in this direction. At the conclusion of the meeting a resolution was passed granting a centenary bonus of £500 to each of the directors.

The Calcutta Electric Supply Corporation, Ltd., held its annual meeting on Monday last, when Lord Meston (chairman), who presided, said that much preparation work had been completed for the super station at Mulajore, and the interconnection scheme was progressing favourably. Sales of electricity for domestic purposes in 1936 rose from 46 to 5 million kWh. It was to be regretted that the response to the reductions in the flat rate was not all they might have hoped for. Industrial consumption, however, increased from 204 to 250 million kWh, in spite of the fact that the jute industry had been passing through a difficult period. The price per ton of coal had risen from 9s. 5d. to 10s. 6d., and they had burned 37,000 tons more than in 1935. Regarding the agitation in Calcutta against their scale of charges, the Calcutta Corporation had intimated its intention to buy in October, 1938, that section of their undertaking within the Corporation's area, but having been informed by the company that it did not accept the intimation as a valid notice of purchase under law, nothing further had so far been done. They had reduced the domestic rate to 2 annas per kWh as from March 1st last, and the cooking and heating rate, as an experiment, from 1 anna to ¾ anna per kWh. In neither case was there any standing charge. They were now working on a schedule for re-forming the tariff to meet the industrial consumer. Owing to the larger capital being put into the business and to the agitation against the company in Calcutta concerning the dividend of 12 per cent., the shareholders were advised that 10 per cent. should be regarded as the standard rate of dividend in the future. Their plan of development continued to require fresh capital, and in order to meet immediate needs it was proposed to issue, in June, 400,000 new ordinary shares to be offered to ordinary shareholders in proportion to their existing holdings at £1 per share. At a subsequent extraordinary meeting a resolution was passed converting the preference and ordinary shares into stock.

The Philco Radio & Television Corporation of Great Britain, Ltd.—Presiding at the first annual meeting held on Tuesday last Mr. H. W. McAteer (chairman) said that last year they had added five bays to their factory at Perivale and now, because of the inadequacy of this accommodation, they were moving a part of their production into a new building. In August last they announced the new "People's" set, and to-day more than 80,000 had been sold. Television had not yet reached the stage at which commercial production was justified, but "Philco" in America was continuing its research and development of this apparatus, and they would commence production as soon as possible.

The St. Austell & District Electric Lighting & Power Co. reports net profits for 1936 of £9,893, as against £8,066 in the preceding year, to which is added £1,927 brought in. The final ordinary dividend is 5 per cent., making 10 per cent., and the dividend on the new ordinary shares is calculated at the rate of 10 per cent. per annum from the due dates of calls. The dividend for the previous year was 10 per cent., plus a bonus of one fully paid ordinary share for every five ordinary shares held.

Richardsons, Westgarth & Co., in their report for 1936, state that while a larger volume of work was turned out, most of the orders were booked while competition was still severe and before prices could be raised appreciably above the unremunerative level which a long period of acute shortage of orders had established. A considerable proportion of the trading loss (£26,909, against £17,053 for 1935) was also due to special expenditure on oil-engine development work. Following the revival in the shipbuilding and engineering industries the company has secured orders at progressively improving prices, and the directors hope that the current year will mark the emergence from the protracted period of unprofitable working. With the debit balance brought in the deficit carried forward is £62,330.

The East London Rubber Co., in its report for the year ended February 28th, states that certain manufacturers of radio instruments decided to change their method of distribution by selling direct to dealers instead of through wholesale distributors. This meant a large loss of trade to the radio department, and as it was impossible to bring overhead expenses into relation with reduced turnover immediately, trading profits amounted to £46,754, as against £64,215. The net profit, after providing for directors' fees, depreciation, &c., amounted to £24,621 (against £40,487), which with £20,928 brought in makes £45,549. The ordinary dividend for the year is 10 per cent., less tax (against 12½ per cent.), and £19,662 is carried forward. Meeting: May 7th.

The Bridgwater and District Electric Supply and Traction Co. reports a net profit of £7,584 for 1936, as compared with £6,959 for 1935. The ordinary dividend for the year is maintained at 6 per cent., and £1,333 is carried forward.

Cable & Wireless (Holding), Ltd., reports that the dividends receivable from subsidiaries for 1936 amounted to £876,785, as compared with £1,039,574 for 1935, which with dividends and interest (gross on investment) and transfer fees makes £986,276. After providing for administration and general expenses, directors' fees, and income-tax, there is a profit of £942,737, as against £1,026,041. It is proposed to pay a dividend of 5½ per cent. on the 5½ per cent. preference stock, being the balance of the dividend in respect of 1934, and a payment of 1⅝ per cent. on account of 1935. The balance carried forward is raised from £167,762 to £188,337. Meeting: May 24th.

Cable & Wireless, Ltd., reports a total revenue for 1936 of £4,734,974, as compared with £5,019,773 in the preceding year, and a profit of £842,945, as compared with £1,001,397. It is proposed to pay a dividend of 2½ per cent. and to carry forward £94,343. In 1935 a dividend of 3½ per cent. was paid, together with a special payment, without tax deduction, of £2 2s. 8d. per cent. out of reserve.

The Eastern Telegraph Co. reports an income of £534,189 for 1936, as against £843,350 for the preceding year. Expenses and interest absorbed £88,515, leaving £445,674, to which is added £13,433 brought in. The dividend on the ordinary stocks for the year is 7½ per cent. (against 6 per cent.), and £14,107 is carried forward.

The Eastern Extension, Australasia & China Telegraph Co. reports an income from investments of £245,120, as compared with £631,786, from which are deducted expenses and debenture interest, leaving £206,690, plus £10,050 brought in. The dividend for the year on the ordinary stock is 5 per cent. (against 9 per cent.), and £16,740 is carried forward.

The Western Telegraph Co. reports an income of £199,717 for 1936, as compared with £495,297 in 1935. After deducting expenses, debenture, and other interest, and adding £8,349 brought in, there is a balance of £169,559 available. A dividend of 5 per cent. is paid on the ordinary stock (against 9 per cent.), and £13,612 is carried forward.

Ensign Lamps, Ltd.—Particulars of this company were published on Monday last for information only. It was incorporated as a private company in 1930, and acquired the assets of the business of electric lamp factors commenced in 1924 by Howarth, Green & Co., Ltd. On April 29th last it was converted into a public company, and it now has an authorised capital of £100,000, of which £75,000 has been, or is to be, issued. The company manufactures general types of electric lamps for industrial and domestic purposes, marketing its products under the names of "Ensign" and "Ribble."

The Ebonite Container Co. reports a net profit for the year ended February 28th, after providing for tax, depreciation, directors' fees, placing £2,000 to general reserve, and including dividend from the subsidiary company, of £17,192, as against £15,740 in the preceding year, to which is added £7,379 brought in. The final dividend is 10 per cent., less tax, plus a bonus of 4 per cent., making 18 per cent. (against 16½ per cent.), and £9,271 is carried forward.

The Lewes & District Electric Supply Co. shows in its annual report for 1936 a net revenue of £16,873, as compared with £17,104 in 1935. After deducting administration and general expenses, &c., there remains £11,485, which, with £6,790 brought in, makes £18,275. General reserve takes £5,000 and after the payment of a dividend of 10 per cent. (same), £7,525 is carried forward.

Laurence, Scott & Electromotors, Ltd., reports a net profit for 1936 of £44,262, as compared with £23,096 in the preceding year, to which is added £5,681 brought in. As announced in our last issue the dividend for the year on the ordinary and "A" ordinary shares is 7 per cent. (against nil), investment reserve receives £10,000 and general reserve £10,000. The balance carried forward is £3,970.

Tube Investments, Ltd., has announced an interim dividend of 7½ per cent. on the ordinary stock (against 5 per cent.), and at the same rate relatively on the liaison shares. The new ordinary shares issued in September last rank for the dividend now declared.

The Calcutta Tramways Co. reports a net profit of £69,846 for 1936, as compared with £82,321 in the preceding year. It is proposed to pay a final ordinary dividend of 5 per cent., making 8 per cent. for the year (against 9 per cent.), and to carry forward £16,670, against £15,325 brought in.

The Oxford Electric Co. reports a balance for 1936, after meeting the preference dividend, of £11,738, to which is added £5,904 brought in. The ordinary dividend is 6 per cent. (against 7 per cent.), and £5,392 is carried forward.

The Craigpark Electric Cable Co.—The Glasgow correspondent of the *Financial Times* reports that the company has received an offer for the purchase of its shares. Full particulars will be sent to shareholders as soon as possible.

Glenfield & Kennedy announce a final dividend of 5 per cent., plus a bonus of 5 per cent., making 15 per cent., less tax (against 10 per cent., plus a capital bonus of 25 per cent.).

The Sphere Investment Trust has declared an ordinary dividend of 5 per cent. for the year ended March 31st on the increased capital (against 4 per cent.).

Companies to be Struck off the Register.—In the list of companies given under this heading in our last issue the Silent Electrical Co., Ltd., should have read Sebut Electrical Co., Ltd.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets are emerging from the effect of heavy over-speculation which spread from New York to Johannesburg. Some weeks ago the Washington authorities endeavoured to curb the American appetite for gambling: President Roosevelt declaimed against the unduly high prices reached by metals and commodities. The Johannesburg Stock Exchange became the scene of heavy liquidation on the apprehension, which proved unfounded, that the United States would cease to buy gold at its present premium. Mr. Neville Chamberlain did nothing to help matters on this side by the introduction of a Budget which revived an obnoxious tax. As a crowning contribution to the *malaise*, the London busmen came out on strike.

What with one thing and another Stock Exchange markets have had a good deal to put up with during the past week or two. Heavy falls took place in many stocks and shares which have no connection with speculative counters, but which had to be sold in order that the holders might realise cash with which to meet losses incurred in Mining shares and American Rails. The fortnightly Settlement which takes place on the Thursday in this week has been regarded with no little misgiving, but, provided it is negotiated without disclosure of open difficulties, the markets are likely to revert to more normal conditions. Indeed, the present week has seen strong recoveries in the prices of stocks and shares which were unduly depressed by the unhappy conditions to which reference has already been made.

Gilt-edged Stocks

With nothing to face worse than the slightly increased rate of income-tax, the gilt-edged market has been able to watch from a detached point of view the flurry, precipitated by the Budget, in most other parts of the "House." Of more direct concern to the market was the launching of the first and substantial part of the Defence Loan. Reception of the latter was far from being enthusiastic, but there was sufficient strength to absorb the issue without causing disturbance to quotations generally. The price of the new issue stands at a trifling discount. Central Electricity Board issues continue in favour: gains of up to 1¼ points were established during the week by the whole range of stocks. London Transport fixed-interest stocks remained fairly firm; the "C" stock, the variable dividend-payer of the group, fell a further 3 points to 84. At this price the stock warrants attention from the specu-

The Castle and Nelson Column, Edinburgh, as they will appear next week

lative investor who is prepared to ignore intermediate fluctuations in the hope that, the bus strike over, a rally will occur later on.

Electricity Supply Shares

Few industrial shares were able to withstand as staunchly the shocks of the last month as was the Home electricity supply group. The market owes, of course, its stability of prices to the corresponding stability of earnings in the industry, the latter factor acting as a protection against heavy penalties under the new tax and as a deterrent to the building of merely speculative positions. The market has been able to join with gilt-edged stocks in standing comparatively aloof from surrounding disorders. Holders of the shares have been well compensated, in this way, for having remained on solid ground during previous spells of general market activity, during which they may well have been tempted, by the prospect of more rapid capital appreciation, into less humdrum avenues. Prices of the shares again show little change on the week. Clyde Valleys, North Metropolitans and one or two others are rather easier.

Manufacturing and Equipment

The market for electrical equipment shares gained strength during the past week. Prices show a decided disposition towards making up lost ground as soon as confidence has gathered sufficient firmness to give a foothold to recovery. Comparison of some of to-day's prices with those obtaining about a month ago provides with a good argument the many who hold that the relapse had gone unreasonably far. General Electrics, which stood at the end of last month at 87s., had fallen to about 80s. before this week's recovery to 85s. Associated Electrical have been down to 46s., against 51s; the present price is 48s. British Insulated, now 5⅛, had fallen from 6 to 5⅜; Crompton Parkinsons, at 60s., have lost about 10s. in the month. The list could, of course, be extended. Telegraph Constructions, having held on to the greater part of this year's big rise, are only fractionally lower than they were a month ago. Ever Ready, helped by the higher distribution, show little change. A striking exception to the general trend has been Brush stock, which, in mounting some 8 points to over 60, has shown a fine disregard for the weakness of the rest of the group. The remoteness of possible penalties under N.D.C. is an explanation calculated to induce mixed feelings in the mind of Brush stockholders.

Cable and Wireless

The Cable and Wireless reports failed to provide any immediate protection to the market against the surrounding depression. Following disclosure in the accounts of a slight falling off in last year's profits, the price of the holding company's "A" ordinary stock fell from 26 to 24 and that of the "B" stock from 6¼ to 5¼. The falls might, it is to be supposed, have gone further had it not been for the favourable trend of current traffics indices and for official expectations of better results this year. In the all-round recovery this week cable stocks played a prominent part, although optimism was tempered to some extent by the ubiquitous threat of N.D.C. The later, however, appears to be of no early concern to ordinary stockholders, provided that the company's suggestion of a possible 4 per cent. dividend this year, on the projected written-down ordinary capital, was not framed on ultra-conservative lines. The rate of earnings on the ordinary capital, however, if the reorganisation goes through, will be relatively high. This being the case, the next tax may be called into play at a later stage of recovery. As will be seen, the prospect is too ringed around with provisions and conditions to permit of anything like a clear view. And, after all, some people cling to the opinion that Mr. Chamberlain will yet scrap his N.D.C. in favour of a less objectionable method for raising the extra twenty to twenty-five million pounds required in a full year.

Stock on Offer

A line of State Electricity Commission of Victoria (Australia) 3½ per cent. stock is on offer in the market at 97 ex dividend. The issue is redeemable up to 1954 by purchase at 100, and a sinking fund is already in operation. The State Electricity Commission generates and sells electricity throughout the State of Victoria, working under Acts of the Parliament of that State. Current revenue is sufficient to meet interest charges more than ten times over. The yield at the price mentioned is £3 12s. per cent. on the money.

Miscellaneous Matters

The speculator's plight spread the results of enforced selling to all the important Continental and other exchanges. Heavy depreciation has occurred in most of the popular transatlantic stocks. Brazilian Tractions, for instance, dropped below 20; the price crossed 30 less than a month ago and has now recovered to 23¼. Rubber shares have been moving in correspondence with the commodity market. Dullness in British Electric Traction deferred, now 1375, reflects the transport trouble. In the iron and steel market falls occurred throughout the list, but were almost entirely recovered in the early part of this week. Switchgear & Cowan shares fell to 16s., rallying later to 17s. 3d. The cheerful tone of the Stock Exchange is in marked contrast to the gloom that prevailed at the end of April. Business, however, runs on quiet lines.

Share List of Electrical Companies

	Dividend. Nom.	Previous.	Last.	Price. May 4.	Rise or Fall.	Yield. p.c. £ s. d.
HOME ELECTRICITY COMPANIES						
Bournemouth and Poole	1	15	15	73/9	—	4 1 9
City of London	1	7½	7½	35/0	−6d.	4 5 9
Clyde Valley	1	7	8	42/6	−1/6d.	3 15 3
County of London...	1	10½	10½	51/6	−6d.	4 1 6
Edmundson's 7% Pref.	1	7	7	33/6	—	4 3 7
Do. Ord.	1	8	8	42/0	−6d.	3 16 3
Elec. Dis. Yorkshire	1	9	9	44/6	−6d.	4 1 0
Elec. Fin. and Securities	1	12½	12½	2½	—	4 7 0
Elec. Supply Corporation ...	1	11	12	57/-	—	4 4 3
Lancs Light and Power	1	7½	7½	35/-	—	4 5 9
Lond. Assoc. Electric	1	—	7	33/3	—	4 4 2
London Electric	1	7	8	36/-	—	4 9 0
London Power Deb. Red. ...	Stock	5	5	106½	—	4 14 0
Metropolitan	1	10	10	50/-	—	4 0 0
Midland Counties	1	7½	8	40/-	—	4 0 0
Mid. Elec. Power	1	8	9	2½	—	4 5 0
North Eastern Electric Ordinary	1	6	7	34/-	—	4 2 4
Do. 7% Pref.	1	7	7	34/6	—	4 1 2
Northampton	1	10	10	48/9	—	4 2 0
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary ...	1	10	10	50/-	−⅛	4 0 0
Do. do. 6% Pref. ...	1	6	6	30/-	—	4 0 0
Scottish Power	1	8	8	40/-	—	4 0 0
South London	1	7	7	32/-	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	22/-	−1/-	6 16 5
Yorkshire Elec.	1	8	8	43/-	−1/-	3 14 5
PUBLIC BOARDS.						
Central Electricity, 1950–70 ...	Stock	5	5	113½	+1	4 8 0
Do. 1955–75 ...	,,	5	5	115½	+½	4 6 7
Do. 1951–73 ...	,,	4½	4½	110½	+1½	4 1 3
Do. 1963–93 ...	,,	—	3½	98xd	+1	3 11 1
London Elec. Trans. Gtd. ...	,,	—	2½	91	—	2 15 0
London & Home Counties, 1955–75	,,	4½	4½	110	—	4 1 10
London Passenger Transport, A...	,,	—	4½	117½	—	3 16 7
Do. do. B...	,,	—	5	118½	−1	4 4 5
Do. do. C...	,,	4	4	84	−3	4 15 3
West Midlands Joint Elec. 1948–68	,,	—	5	112½	—	4 9 0
TELEGRAPH AND TELEPHONE.						
American Tel. & Tel.	$160	9	9	170½	+3	5 5 7
Anglo-Am. Tel. Pref.	Stock	6	6	120	—	5 0 0
Do. Def.	,,	1½	1½	29	—	5 3 5
Cable & Wireless 5½% Pref. ...	,,	4½	5½	109½	+½	5 0 6
Do. A. 7½% Ord.	,,	Nil	Nil	25½	−½	—
Do. B. Ord.	,,	Nil	Nil	6½	—	—
Globe Tel. & Tel. Ord.	10	3½*	4½*	16	—	2 16 5
Do. do. Pref.	10	6	6	13½	—	4 8 0
Great Northern Tel.	10	20	20	43	—	4 13 0
Marconi-Marine	1	10	7½	1½	—	4 5 9
Oriental Telephone Ord.	1	12*	12*	3½	—	3 16 10
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	7/-	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	22½	−1	—
British Electric Traction Df. Ord.	,,	5	5	1375	−75	—
Do. do. Pref. Ord.	,,	8	8	165	—	4 15 5
Brazil Traction	$100	—	70 cts.	23½	+½	—
Brit. Columbia Elec. Rly. Pcs. ...	Stock	5	5	104½	—	4 14 9
Mexican Light Common	$100	Nil	Nil	3½	−1	—
Do. 1st Bonds	$500	5	5	43½	—	—
Victoria Falls Ord.	1	20	12	67/6	−⅛	3 11 2
West Riding	1	6½	10	47/-	—	4 5 2
MANUFACTURING COMPANIES						
Aron Electricity Ord.	1	10	15	2½	−½	5 9 1
Assoc. Elec. Ord.	1	8	10	48/6	+2/-	4 2 6
Do. Pref.	1	8	8	38/-	—	4 4 3
Babcock & Wilcox	1	8	10	48/9	+1/9	4 2 1
British Aluminium Ord.	1	7½	10	51/-	−1/6	2 18 6
British Insulated Ord.	Stock	20	20	5½	+1.4	3 11 2
Brush Ord.	Stock	Nil	Nil	60½	+4	—
Callender's	1	15	15	4⅛	+½	.3 5 9
Do. 6½% Pref.	1	6½	6½	30/-	—	4 6 8
Crompton Parkinson Ord. ...	5/-	12½	12½	60/-	−½	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	3½	7	37/6	—	3 14 8
Enfield Cable Ord.	1	25	25	5⅛	+⅛	4 16 2
English Electric	1	Nil	Nil	32/-	+1/-	—
Do. do. Pref.	1	6½	6½	24/6	—	5 8 4
Ericsson Tel.	5/-	20	25	48/9	—	2 11 3
Ever Ready	5/-	35	45	31/-xd.	—	7 5 2
Ferranti Pref.	1	7	7	26/3	—	5 6 8
G.E.C. Pref.	1	6½	6½	31/3	—	4 3 2
Do. Ord.	1	10	15	85/-	+3/-	3 10 7
Henleys	5/-	30	15	19/3	+6d.	3 18 0
Do. 4½% Pref.	1	4½	4½	1½	—	4 6 0
India-Rubber Pref.	1	5½	5½	22/6	—	4 17 9
Johnson & Phillips	1	7½	10	45/-xd.	—	4 9 0
Lancashire Dynamo	1	10	20	3⅛	—	5 16 3
Siemens Ord.	1	5	6	32/6	+⅛	3 13 10
Telegraph Construction	£1	Nil	7½	2⅛	—	3 8 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1935

19471. "Remote-controlled electrical reversing switches." L. S. E. Ellis. (Schorch-werke Akt.-Ges.) July 8th, 1935. (Convention date not granted.) (463722.)

23476. "Signs for advertising and other purposes comprising luminous electric discharge tubes." J. Fodor and Pisagua Holdings, Ltd. August 21st, 1935. (Cognate applications 23616/35 and 23617/35.) (464023.)

24653. "Electric communication systems." Telephone Manufacturing Co., Ltd., and L. H. Paddle. September 4th, 1935. (463795.)

24983. "Screening of electric cables or other electrical apparatus." Allgemeine Elektricitats-Ges., and M. Raht. September 7th, 1935. (463866.)

27324. "Voltage-regulating apparatus for alternating-current electric circuits." Foster Engineering Co., Ltd., and R. I. Bagnall. October 3rd, 1935. (463947.)

27405. "Automatic electric welding." Union Carbide & Carbon Research Laboratories, Inc. November 9th, 1934. (463954.)

27464. "Apparatus for use in recording sound intensities." G. Neumann. October 5th, 1934. (Cognate applications 27465/35 and 27466/35.) (464027.)

27504. "Electric selectors set by impulses." C. E. Every-Clayton (Nationale Telephon-und Telegraphenwerke Ges.) October 4th, 1935. (464029.)

27594. "Apparatus for the substantially uniform illumination of a surface." Quarzlampen-Ges. October 6th, 1934. (463870.)

27658. "Electric-discharge lamps." British Thomson-Houston Co., Ltd., and L. J. Davies. October 7th, 1935. (463873.)

27662. "Telephone systems." Automatic Electric Co., Ltd., November 7th, 1934. (463874.)

27666. "Television transmitter." Radioakt-Ges. D. S. Loewe. October 11th, 1934. (464049.)

27782. "Circuits including electric-discharge devices." British Thomson-Houston Co., Ltd., J. H. Mitchell and W. J. Scott. October 8th, 1935. (463877.)

27783. "Clamps for electrical insulators." British Thomson-Houston Co., Ltd., and W. S. Adams. October 8th, 1935. (463965.)

27805. "Television transmitters." Marconi's Wireless Telegraph Co., Ltd. October 26th, 1934. (463967.)

27815. "Key-operated electric switches." T. A. Tisdell, W. Rae and Amal, Ltd. October 8th, 1935. (463968.)

27819. "Television and like systems." Baird Television, Ltd., and L. R. Merdler. October 8th, 1935. (Cognate applications 29311/35 and 29864/35.) (463971.)

27820. "Deflecting means for cathode-ray tubes or the like, and scanning generators associated therewith." Baird Television, Ltd., and G. R. Tingley. October 8th, 1935. (463972.)

27821. "Television and like systems." Baird Television, Ltd., and L. R. Merdler. October 8th, 1935. (463973.)

27861. "Electric resistance alloys." British Driver-Harris Co., Ltd. October 12th, 1934. (Addition to 438140.) (464033.)

27863. "Electric liquid level gauges." H. E. W. West. October 9th, 1935. (464103.)

27907. "Electron-discharge devices." S. T. Henderson. October 9th, 1935. (464105.)

27971. "Radio receivers for television or like purposes." Baird Television, Ltd., and L. R. Merdler. October 10th, 1935. (464037.)

28004. "Two-way telephone systems." Marconi's Wireless Telegraph Co., Ltd., H. J. H. Wassell and J. P. Wykes. October 10th, 1935. (464039.)

28127. "Compensating networks for electrical transmission circuits." Standard Telephones & Cables, Ltd., and D. G. Reid. October 11th, 1935. (464052.)

28128. "Electric signalling systems." Standard Telephones & Cables, Ltd. (W. Hatton and C. Lardot.) October 11th, 1935. (Cognate application 32742/35.) (464109.)

28168. "Impulse repeaters for use in telephone systems." Automatic Electric Co., Ltd., C. E. Beale and I. T. Richards. October 11th, 1935. (464058.)

28442. "Metal-vapour discharge apparatus and especially mercury-vapour rectifiers." English Electric Co., Ltd. (Siemens-Schuckertwerke Akt.-Ges.) October 15th, 1935. (463982.)

28894. "Electric welding of hollow articles." Austin Motor Co., Ltd., and H. Poole. October 19th, 1935. (463802.)

29144. "Electric lamps." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) October 22nd, 1935. (463803.)

29751. "Outdoor electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. October 28th, 1935. (463987.)

31162. "Electric welding appliances." English Electric Co., Ltd., and C. A. Bourne. November 11th, 1935. (Cognate application 14445/36.) (463809.)

31292. "Apparatus for charging electric storage batteries." Chance Bros. & Co., Ltd., and L. B. H. Hallett. November 12th, 1935. (463740.)

31293. "Indirectly heated cathodes of cathode-ray tubes." Dr. G. Seibt Akt.-Ges. November 13th, 1934. (463741.)

32896. "Electric suspension insulators." W. W. Triggs (Ohio Brass Co.). November 27th, 1935. (463812.)

33040. "Magneto-electric machines." British Thomson-Houston Co., Ltd., and L. Griffiths. November 28th, 1935. (463813.)

33508. "Circuit arrangements for reducing the influence of fluctuations of mains potential and load on the potential supplied by a rectifier." Siemens-Schuckertwerke Akt.-Ges. December 4th, 1934. (Cognate applications 33509/35 and 33510/35.) (463992.)

34426. "Muting in radio receivers." E. K. Cole, Ltd., and A. W. Martin. December 12th, 1935. (463748.)

1936

2151. "Apparatus for receiving television and the like." General Electric Co., Ltd., and G. C. Marris. January 23rd, 1936. (463888.)

2285. "Intermediate glasses for sealing conductors into quartz vessels." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). January 24th, 1936. (Cognate application 7525/36.) (463889.)

3474. "Cathode-ray apparatus for receiving television and the like." General Electric Co., Ltd., and L. C. Jesty. February 5th, 1936. (463891.)

4533. "Combinations of electric-discharge devices and luminescent materials." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen). February 14th, 1936. (463755.)

6076. "Osillights or cathode-ray tubes." P. T. Farnsworth. February 28th, 1936. (463896.)

6251. "Cathode-ray tubes, image-dissecting tubes, and the like." Farnsworth Television, Inc. March 13th, 1935. (463829.)

6395. "Device for producing mechanical motion by means of an electrostatic relay." Dr. O. Urbanek and T. Pogany. March 3rd, 1936. (463897.)

11052. "Electric cigar or cigarette lighters." I. Florman. May 22nd, 1935. (463834.)

11090. "Radio receiving systems." A. N. Mann. April 18th, 1935. (463903.)

11720/1. "Arc lamps." Clarke, Chapman & Co., Ltd., W. A. Woodeson and F. L. Turnbull. April 24th, 1936. (463835/6.)

12347. "Electric tumbler or double press-button snap-action switches." W. Bollinghaus. April 30th, 1936. (463906.)

14767. "Electric coupling plugs." I. Keesing. May 31st, 1935. (463842.)

17356. "Back-coupled circuit for cathode-ray tube, more especially for television purposes." E. Michaelis. June 22nd, 1935. (464064.)

17911. "Apparatus for generating electrical waves corresponding to fluid medium waves." Brush Development Co. June 27th, 1935. (463766.)

19918. "Arc-current rectifiers." Siemens-Schuckertwerke Akt.-Ges. August 12th, 1935. (463914.)

19936. "Plug sockets and switch plug sockets for electrical connections." W. Bollinghaus. July 17th, 1936. (463915.)

20434. "Automatic distress-signal transmitter with number-setting mechanism for sending selector impulses over a subscriber's line to an automatic telephone exchange." Telefonaktiebolaget L. M. Ericsson. August 8th, 1935. (463771.)

20528. "Electro-mechanical wave filter devices." Standard Telephones & Cables, Ltd. August 13th, 1935. (463848.)

21449. "Illuminating installations, more particularly for flying grounds." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 7th, 1935. (463918.)

21841. "Radio directional receiving systems." Telefunken Ges. für Drahtlose Telegraphie. August 7th, 1935. (464075.)

22416. "Cathode-glow lamps." General Electric Co., Ltd. August 31st, 1935. (463853.)

25342. "Four-pole networks having amplitude-dependent attenuation characteristics." Siemens & Halske Akt.-Ges. September 17th, 1935. (464078.)

26075. "Electric current rectifiers operating with rotating conductive liquid jets." Siemens-Schuckertwerke Akt.-Ges. October 28th, 1935. (463857.)

27475. "Liquid-break electric circuit-breakers." British Thomson-Houston Co., Ltd. October 12th, 1935. (463929.)

29560. "Protective circuits." British Thomson-Houston Co., Ltd. October 30th, 1935. (464088.)

30925. "Electric control devices." British Thomson-Houston Co., Ltd. November 13th, 1935. (464090.)

31090. "Electrical contact plugs or pins." E. Kleinmann and A. Mendel. November 13th, 1935. (463781.)

31608. "Single-phase mercury vapour rectifying valves." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 21st, 1935. (Addition to 456243.) (463859.)

31612. "Dynamo-electric machines and rotor elements therefore." British Thomson-Houston Co., Ltd. November 19th, 1935. (463783.)

32680. "Electrically operated printing apparatus." E. O. Chapman, C. V. Hart and F. G. Marquiss. November 28th, 1936. (463935.)

35343. "Moving-contacts of electric switches." C. H. Parsons, Ltd., and G. B. Handley. December 24th, 1936. (463788.)

1937

3858. "Wireless communication systems." L. L.-K. Honeyball. July 4th, 1935. (Divided out of 19096/35.) (463938.)

4915. "Television transmission." Radioakt.-Ges. D. S. Loewe. September 4th, 1934. (Divided out of 22115/35 and 22116/35.) (463863.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered wihtin one month from April 28th:—

Philips. No. 566547. Class 8. Wireless receiving apparatus, current rectifiers, light measuring instruments, current and voltage indicators, electric transformers, photo-electric cells, &c. No 566549. Class 13. Electric lamps (ordinary), electric lighting fittings and lamp reflectors.—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Arvin. No. 576189. All goods in Class 8.—Arvin Electric Co., Ltd., Shropshire House, 179, Tottenham Court Road, W.1.

Bow and Arrow (design only). No. 575396. Electrodes of ordinary metal for electric welding.—La Société La Soudure Electrique Autogene, Brussels (British representatives, Imperial Patent Service, First Avenue House, High Holborn, W.C.1.).

Kryptopal. No. 573986. Class 13. Electric lamps (ordinary).—Egyesult Izzolampá es Villam Ossagi Reezrenytarsasag, Vaczi, Hungary (British representatives, Lloyd Wise & Co., 10, New Court, Lincoln's Inn, W.C.2).

Scotesco. No. 576244. All goods in Class 18.—The Scottish Power Co., Ltd., 10, Melville Street, Edinburgh.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abercarn (Monmouthshire).—Houses (32), Cwmcarn and Newbridge; J. Williams, U.D.C. surveyor.

Aberystwyth.—Business premises, site of North Parade Hotel, for Montague Burton, Ltd., Leeds.

Aylsham.—Cinema, for the Aylsham Cinema Co., Norwich; V. E. Harrison, director, Ipswich Road, Norwich.

Bedfordshire.—School, Luton (£63,596), for County E.C.

Birkenhead.—Complete rebuilding of Park Cinema (1,700 seats), Park Road East (£40,000), for the Gaumont British Picture Corporation; W. S. Trent, architect. Houses (198), Vyner estate (£78,689); E. B. J. Gould, Ltd., builders, Ellesmere Port.

Birmingham.—Factory, Hunter's Vale, for R. Nicholls & Co. (£25,000), with electrical work; J. H. Parsons, builders, 92, High Street, King's Heath.

Blaydon-on-Tyne.—Houses, Barlow; U.D.C. surveyor.

Bolton.—Houses (50), near Long Lane; Park & Co.

Brownhills (Walsall).—Houses (200); N. Waine, clerk, Council Offices.

Buxton.—Houses (40), Victoria Park estate; H. Firth, builder, Sowerby Bridge.

Byfleet (Woking).—Houses (25), Church Road; W. F. Summers.

Chelmsford.—Houses (42), Widford; V. J. Willis, borough surveyor.

Cheltenham.—Factory and offices, Whaddon estate; Crosweller & Co., Ltd.

Cheshunt (Hertfordshire).—Cinema (1,229 seats), Turner's Hill, for J. C. Cruttwell, Glendor Gardens, London, N.W.7.

Coventry.—Houses (180), Mercer Avenue, Barras Green, and block of shops and flats, Warwick Road, for the Central Estates, Ltd., Lockhurst Lane; W. H. Jones & Son, builders, Lockhurst Lane.

Cuckfield.—Houses (24), Cuckfield and Lindfield; T. White, builder, Haywards Heath.

Darlaston.—Cinema, Pinfold Street (£30,000); J. & F. Wooton, Ltd., builders, Bloxwich.

Devonshire.—Nurses' home and hospital block, Hawkmoss Sanatorium, Bovey Tracey, for County Council; H. V. de Courcy Hague, county architect, Exeter.

Dorking.—Factory, for H. G. Kingham & Co., Station Road.

Dudley.—Factory, Wolverhampton Road, for Green & Hughes, Ltd., Churchbridge, Oldbury (£20,000), with electrical work; J. Hickman & Son, builders, Willenhall. Opera House, Castle Hill; B. Kennedy, Plaza Cinema.

Eastbourne.—Cinema, Junction Road; W. T. Benslyn, architect. Maternity home, Upperton Road (£15,498); Rice & Son, Ltd.

Edmonton.—Extensions to Chase Farm schools (£31,788); J. Cronk, Ltd.

Emley (Huddersfield).—Houses (22); G. M. Barr, architect, Westfield Flockton, near Wakefield.

Enfield.—Houses (207), Hillview estate; Hamilton, Son & Campion.

Essex.—Premises for County High School for Girls, Colchester (£51,601), for County E.C.

Eton.—Houses, Thorney Road, Iver, and Tockley Road, Burnham; R.D.C. surveyor.

Evesham.—Houses (20), three sites; R. J. Atkinson, R.D.C. surveyor.

Farnham (Surrey).—Houses (62), Wrecclesham; U.D.C. surveyor.

Fenton (Staffordshire).—Houses (360); Heron Cross; C. F. Whittaker.

Gateshead-on-Tyne.—Factory, for Hunters, Ltd., East Street.

Glasgow.—Houses, Broomloan Road. and Garscube; housing director. Houses (300), Netherton; architect, Housing Dept., City Chambers.

Great Berkhamsted.—Offices and Council chamber, High Street; surveyor, Council Offices, Berkhamsted.

Hanley.—Houses (40), Cromer Road; Holloway & Co.

Hinckley.—Extensions to factory for A. Davenport & Sons, Wood Street.

Hull.—Houses (166), Bilton Grange estate (£56,600); Sims, Sons & Cooke, Ltd.

Ipswich.—Houses (548), Whitton estate; E. MacLauchlan, borough surveyor.

Irish Free State.—(Dundalk, Co. Louth).—Houses (30); J. F. Doris, engineer and town surveyor, Town Hall. (Tralee, Co. Kerry).—Extensions and alterations to Central Technical School, for the Vocational E.C.; B. O'Flynn & Sons, architects, 60, South Mall, Cork.

Jarrow-on-Tyne.—Houses (150); borough engineer.

Knutsford.—Houses (30), Warren Avenue site; U.D.C. surveyor.

Lancashire.—Hospital, Ulverston (£75,000), for C.C.

Leeds.—Houses (204); housing director.

Leicester.—School, Ingle Street (£20,522), for E.C.

Leith.—Aerated water factory, 47 and 47a, West Bowling Green Street; G. G. M'Phie, 1, Mill Lane.

Liverpool.—Fire station, Speke estate (£24,000); city engineer.

London.—(Bethnal Green).—Rehousing, Emma Street and Vyner Street areas (£127,500); L.C.C. architect. Extensions to Town Hall (£109,847); borough engineer. (Finchley).—Health centre, Oak Lane (£13,800); borough engineer. Trolley bus station, Regent's Park Road; London Passenger Transport Board, 55, Broadway, Westminster, S.W.1. (Greenwich).—Town hall and municipal offices, junction of London Street and Royal Hill; Culpin & Son, architects, 3, Portsmouth Street, W.C.2. (Hammersmith).—Cinema, Uxbridge Road; Merrick, Graves & Co., Ltd., Westbourne House, Station Approach. (Lewisham).—Nursery, Ladywell institution (£81,600); L.C.C. architect. (Paddington).—Cinema, Westbourne Grove; Andrew Mather, Leicester Square Chambers, Leicester Square, W.C.2. Shops and flats, Bishop's Road, Porchester Road, Edgware Road and Titchborne Street; Toms & Partners, 115, Park Street, W.1. Shops and flats, Eastbourne Terrace, James Street and Eastbourne Mews; Howard Leicester & Partners, 6, Southampton Street, W.C.1. Shops and flats, Maida Vale and Carlton Vale; Caroe & Passmore, 3, Great College Street, S.W.1. (Rotherhithe).—Shops and flats, Albion Street; Purvis & Purvis, 417, New Cross Road, S.E.14. (Southwark).—Tenements and shops, Rockington estate (£271,300); L.C.C. architect. (Stoke Newington).—Factory, Stoke Newington Road: H. Bradford & Sons, 37, Shacklewell Lane, E.8. Extensions to factory, High Street; Commercial Structures, Ltd., Staffa Road, E.10.

Lowestoft.—Houses (64), three sites; S. W. Mobbs, borough surveyor.

Maidenhead.—Houses (22), St. Mark's Road; J. W. Slatter & Son, builders, Cromwell Road.

Manchester.—Flats (49), Red Bank (£23,915); city architect.

Mansfield.—Museum and art gallery, Leeming Street; W. Thompson, borough surveyor, Carr Bank.

Middlesbrough.—Cinema, Acklam; W. E. Haslock, architects, Albert Road, Middlesbrough.

Neath.—Factory for the Eaglebush Tin Plate Co., Ltd.

Newcastle-on-Tyne.—Houses (54), Coxlodge; borough surveyor.

Northolt.—Estate development, Ruislip Road, Church Road and West End Road; Henry Boot Garden Estates, Ltd.

Norwich.—Cinema for the Odeon Theatres, Ltd.; H. W. Weedon, architect, 84, Colmore Row, Birmingham.

Nottingham.—Houses (90); E. Phillips, housing architect, Exchange Buildings East.

Nuneaton.—Houses (30), Chapel End; Gudgeon & Sons, builders, New Street, Attleborough. Shops and flats, Newdegate Street; Paul & Sons, builders, Burbage.

Oldbury.—School (£33,050), for E.C.

Padiham (Burnley).—Houses (56); U.D.C. surveyor.

Peterborough.—School, Walton; S. Dodson & Son, architects, Museum Buildings, Priestgate.

Rowley Regis.—Houses, Throne Road estate (£147,544), and Codsall estate (£96,293); H. B. Williams (trading as Walter Basterfield), builder.

St. Albans.—Houses (34), Sleapshyde, Smallford; C. Huskinson, R.D.C. surveyor, 43, Upper Lattimore Road.

Salford.—School, Lancaster Road, Pendleton, for E.C.; P. Howard, 88, Mosley Street, Manchester.

Sheffield.—Maternity ward, City Hospital (£24,443); W. G. Robson, Ltd.

Sittingbourne.—Houses (28), Elm Grove; W. H. Neale, Ltd., builders.

Slough.—Cinema, Beechwood Gardens estate, Windsor Road (£50,000), for A.G.T., Ltd., 13, Essex Street, Strand, London, W.C.2.

Solihull.—Additions to Solihull grammar school; T. Lowe & Sons, builders, Burton-on-Trent.

Southall.—Factory, Witley Gardens; Haigh & Sons, Ltd. Shops and flats, Uxbridge Road; Geo. Wimpey & Co., Ltd.

Southgate.—Factory, Chase Side; C. W. D. Walden, Ridge Avenue, London, N.21. School, Wilmer Way (£35,380); Raglan Building Co., Ltd., King's Court, Forty Lane, Wembley Park.

Stirlingshire.—School, model village of Westquarter, Stirling (£28,000), for C.C.; Mr. Grant, County Buildings, Stirling.

Stoke-on-Trent.—Houses (64), Cornhill estate (£24,706): C. Cornes & Son. Houses (55), John Street, Longton; city architect. Houses (27), near Milton Road, Sneyd Green; B. S. Phillips.

Stourbridge.—Houses (84), Hodge Farm estate, Wollescote F. Woodward, borough surveyor, Council House.

Stroud.—Houses (38), Whiteshill; R.D.C. surveyor.

Sunderland.—Houses (30), North Hylton; R.D.C. surveyor. Rebuilding Thomas Street schools, for County E.C.; education architect, Education Offices.

Surrey.—Hospital block and extensions to Nurses' Home, Brookwood Mental Hospital, for C.C.; clerk, Kingston-on-Thames. School, Wrythe Lane, Carshalton Green (£20,571), for County E.C.; county architect, Kingston-on-Thames.

Tipton.—Houses (74), Tibbington estate; C. B. Gallie, housing architect, Sedgeley Road West.

Tottenham.—Factory, Hampden Lane; Meakin, Archer & Co., 127, Queen Victoria Street, E.C.4. Factory, Markfield Road; Mills Equipment Co., Ltd., Fountayne Road, N.15. Extensions to Stirling works, Clyde Road; Lieberman & Harding, Ltd., Philip Lane, N.15.

Tow Law.—Houses (36), for the North-Eastern Housing Association, Newcastle-on-Tyne; Cordingley and McIntyre, architects, The College, Durham.

Warrington.—Houses, Long Lane estate and Westy Lane estate; borough surveyor.

Weston-super-Mare.—Houses (36), and shops; Blake Bros., builders.

Wigan.—Extensions to the Queens' Cinema, Ormskirk Road, Pemberton, for the Eagle Picturedromes, Ltd., King Street; W. Ellis, Union Bank Buildings, Hardshaw Street, St. Helens.

Wolverhampton.—Additions to aircraft factory, Boulton & Paul, Ltd. (£160,000), with electrical work; Hattrell & Wortley, architects, Queen's Road, Coventry.

Worcestershire.—School, Pedmore Road, Stourbridge, for County E.C.; A. V. Rowe, county architect, 38, Foregate Street, Worcester.

Yaxley.—Houses (300); Goodwin and Pywell.

York.—Houses (182), Gale Lane estate (£69,850); Sheriff & Co., Ltd.